RADIO NEWS

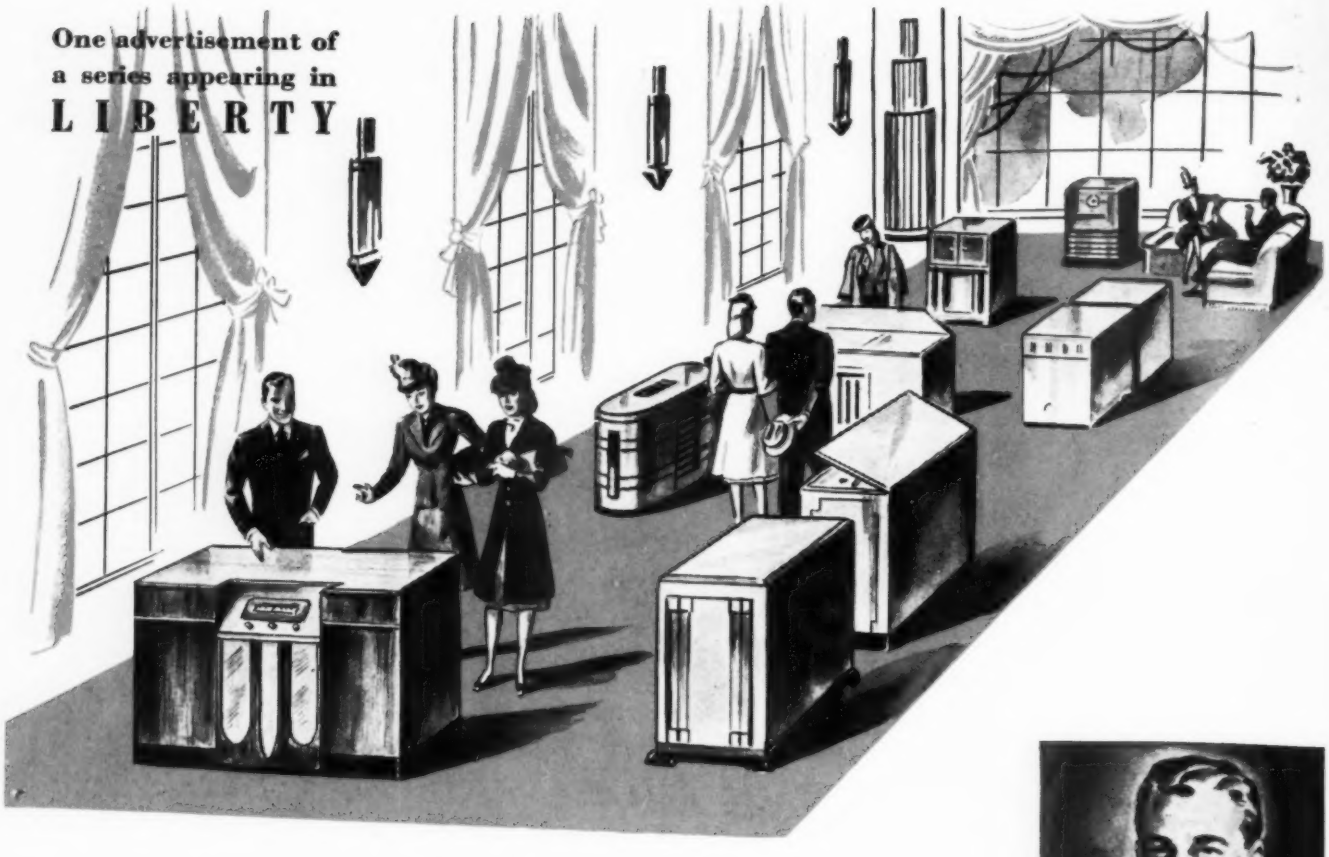
MAR 23 19

APRIL
1945
35c

EERING
RARY

PROJECTED VIDEO ON
RCA POSTWAR MODEL

One advertisement of
a series appearing in
LIBERTY



Buy Your New Radio from Your *Radio Dealer*

FACE TO FACE
RECEPTION

"You will get more satisfaction—better value—from a radio bought through a radio *specialist*—your local radio dealer.

"You will get every worth-while improvement—because my years of experience and technical knowledge enable me to choose the best available values in postwar models.

"Many of us dealers have chosen the line of Meck Radios—because they offer you outstanding engineering advancements as well as a reputation for quality firmly established through years of building world-famed electronic products."

Your Radio Dealer

Meck Radios will be sold by leading independent radio dealers.

MECK RADIOS

JOHN MECK INDUSTRIES, Inc. • PLYMOUTH, INDIANA, U. S. A.

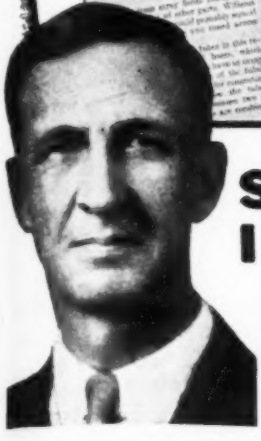
TABLE MODELS • PORTABLES • CONSOLE COMBINATIONS • PHONOGRAPHS

Get this FREE Lesson in Radio

Gives you a real start toward understanding these subjects

With 31 Photos, Sketches, Radio Drawings

How superheterodyne circuits work
How to remove tubes, tube shields
Three reasons why Radio tubes fail
Electrodynamic loudspeaker:
  How it works
  Replacing damaged cone
  Recentering voice coil
  Remedies for open field coil
Output transformer construction, repair
Gang Tuning condenser:
  Construction of rotor, stator
  How capacity varies
  Restringing dial cord
  Straightening bent rotor plates
I.F. transformers:
  What they do, repair hints
How to locate defective soldered joints
Inside story of carbon resistors
Paper, electrolytic, mica, trimmer condensers
How condensers become shorted, leaky
Antenna, oscillator coil facts
Power transformer:
  Construction, possible troubles
Installing power cord
Troubles of combination volume control, on-off switch
Tone controls
Dial lamp connections
Receiver servicing technique:
  Checking performance
  Testing tubes
  Circuit disturbance test
Isolating defective stage
Locating defective part



See For Yourself How I Train You at Home to BE A RADIO TECHNICIAN

I want to give every man who's interested in Radio, either professionally or as a hobby, a copy of my Lessons, "Getting Acquainted with Receiver Servicing"—absolutely FREE! It's a valuable lesson. Study it—keep it—use it—without obligation! And with it I'll send my 64-page, illustrated book, "Win Rich Rewards in Radio," FREE. It describes many fascinating jobs in Radio, tells how N.R.I. trains you at home in spare time, how you get practical experience with SIX KITS OF RADIO PARTS I send.

The "Sample" Lesson will show you why the easy-to-grasp lessons of the N.R.I. Course have paved the way to good pay for hundreds of other men. I will send it to you without obligation. MAIL THE COUPON!

Future for Trained Men is Bright in Radio, Television, Electronics

The Radio Repair business is booming NOW. There is good money fixing Radios in your spare time or own full time business. And trained Radio Technicians also find wide-open opportunities in Police, Aviation and Marine Radio, in Broadcasting, Radio Manufacturing, Public Address work, etc. Think of the boom coming when new Radios can be made! And think of even **greater** opportunities when Television, FM, Electronics, can be offered to the public! Get into Radio NOW.

Many Beginners Soon Make $5, $10 a Week EXTRA in Spare Time

The day you enroll I start sending EXTRA MONEY JOB SHEETS to help you make EXTRA money fixing Radios in spare time while learning. You LEARN Radio principles from my easy-to-grasp Lessons—PRACTICE what you learn by building real Radio Circuits with the six kits of Radio parts I send—USE your knowledge to make extra money while getting ready for a good full time Radio job.

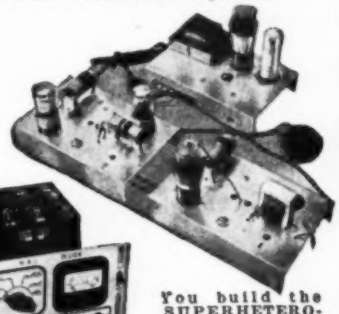
Find Out What N.R.I. Can Do for YOU

MAIL COUPON for Sample Lesson and FREE 64-page book. It's packed with facts about opportunities for you. Read the details about my Course. Read letters from men I trained, telling what they are doing, earning. Just MAIL COUPON in an envelope or paste it on a penny postal.—**J. E. SMITH, President, Dept. 5DR, National Radio Institute, Pioneer Home Study Radio School, Washington 9, D. C.**

Our 31st Year of Training Men for Success in RADIO

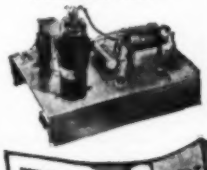
You Build These and Many Other Radio Circuits with 6 Kits of Parts I Supply

By the time you've conducted 60 sets of Experiments, made hundreds of measurements and adjustments, you'll have valuable PRACTICAL Radio experience.



You build **MEASURING INSTRUMENT** above early in Course, useful for Radio work to pick up EXTRA spare time money. It is a vacuum tube multimeter, measures A.C., D.C., R.F. volts, D.C. currents, resistance,, receiver output.

You build the **SUPERHETERODYNE CIRCUIT** above containing a preselector oscillator-mixer-first detector, i.f. stage, diode-detector-a.v.c. stage and audio stage. It will bring in local and distant stations. Get the thrill of learning at home evenings in spare time while you put the set through fascinating tests!



Building the **A. M. SIGNAL GENERATOR** at right will give you valuable experience. Provides amplitude-modulated signals for test and experimental purposes.

I TRAINED THESE MEN

Has Own Radio Shop

"I made $12 a week in a store. Now I own my repair shop. Often clear $35 to $45 week."—**Frederick Bell, 76 Golf Ave., St. Johns, Newfoundland.**

$600 a Year in Spare Time

"Doing spare time radio work. I earned money in radio before graduating. Profit last 12 months was $600."—**E. F. Boettcher, Marinette, Wis.**

In Aircraft Radio

"I do radio work at Greenwood Army Air Field, and operate a radio shop in spare time."—**James L. Boyett, P.O. Box 218, Greenwood, Miss.**

Network Engineer

"I began N.R.I. training when I was 16. Am now transmitter engineer for one of the networks."—**Theodore Campbell, Johnstown, Pa.**

My Radio Course Includes
TELEVISION • ELECTRONICS
FREQUENCY MODULATION

GOOD FOR BOTH 64 PAGE BOOK SAMPLE LESSON FREE

Mr. J. E. Smith, President, Dept. 5DR
NATIONAL RADIO INSTITUTE, Washington 9, D. C.

Mail me FREE without obligation, Sample Lesson and 64-page book, "Win Rich Rewards in Radio." (No salesman will call. Please write plainly.)

Age.....

Name .....

Address .....

City .....Zone.....State.....4FR

RADIO NEWS
Reg. U. S. Pat. Off.

APRIL • 1945 VOLUME 33, NUMBER 4

CONTENTS

FEATURES

Communications on the World's Greatest Airline..... *Lt. Col. Howard J. Haines* 25
Dad's Advice to G.I. Joe..... *Russell J. Paige* 28
Phasing of Loud Speakers..... *Nicholas B. Cook* 30
The Television Receiver..... *Edward M. Noll* 32
A New Portable Disc Recorder..... *P. Peters* 35
Emergency Radio Receiver Tests..... *Capt. Stuart D. Distelhorst* 36
Direct-Reading Impedance Meter..... *Guy Dexter* 38
Servicemen's Guide to Priority Purchasing... *Eugene Carrington* 40
Wired-Radio Intercom..... *Rufus P. Turner* 42
G.I. Plans for Postwar Shop..... *Harold F. Hetrick* 46
Servicing Hints on Auto Radio Interferences..... *M. S. Kay* 48
Practical Radio Course..... *Alfred A. Ghirardi* 50
Tube Substitution Chart..... *Richard W. Crane* 51
118-mc. FM Proves Successful..... *W. G. McNulty* 52
Theory and Application of U.H.F..... *Milton S. Kiver* 57
It's a Bantamweight..... *Harold Cohen* 64
Killion's Wartime Plans..... *Eugene A. Conklin* 68
Profession—Flight Radio Officer..... *Raymond Lewis* 80

DEPARTMENTS

For the Record..... 8
Spot Radio News..... 12
Let's Talk Shop..... *Joe Marty* 45
International Short-Wave..... *Kenneth R. Boord* 54
QTC..... *Carl Coleman* 56
Technical Book and Bulletin Review..... 72
What's New in Radio..... 74
Within the Industry..... 112
Manufacturers' Literature..... 128
Letters from Our Readers..... 132

COVER PHOTO
By Frank Ross
(Staff Photographer)

Television receivers employing projection principles, as shown on the cover, will most likely be featured postwar. There are many advantages, chiefly among these being larger viewing screens, permitting greater reception pleasure for the public.

WILLIAM B. ZIFF
Publisher

B. G. DAVIS
Editor

C. R. TIGHE
Ass't to Publisher

OLIVER READ, W9ETI
Managing Editor

WM. A. STOCKLIN
Associate Editor

HAROLD S. RENNE
Technical Editor

JOE MARTY, JR.
Eastern Editor

FRED HAMLIN
Washington Editor

HERMAN R. BOLLIN
Art Director

E. H. SEHNERT
Chief Draftsman

K. R. PORTER
War Correspondent

FRANK ROSS
Staff Photographer

GEORGE BERNER
Advertising Director

S. L. CAHN
Advertising Mgr.

J. M. ECKERT
Midwest Adv. Mgr.

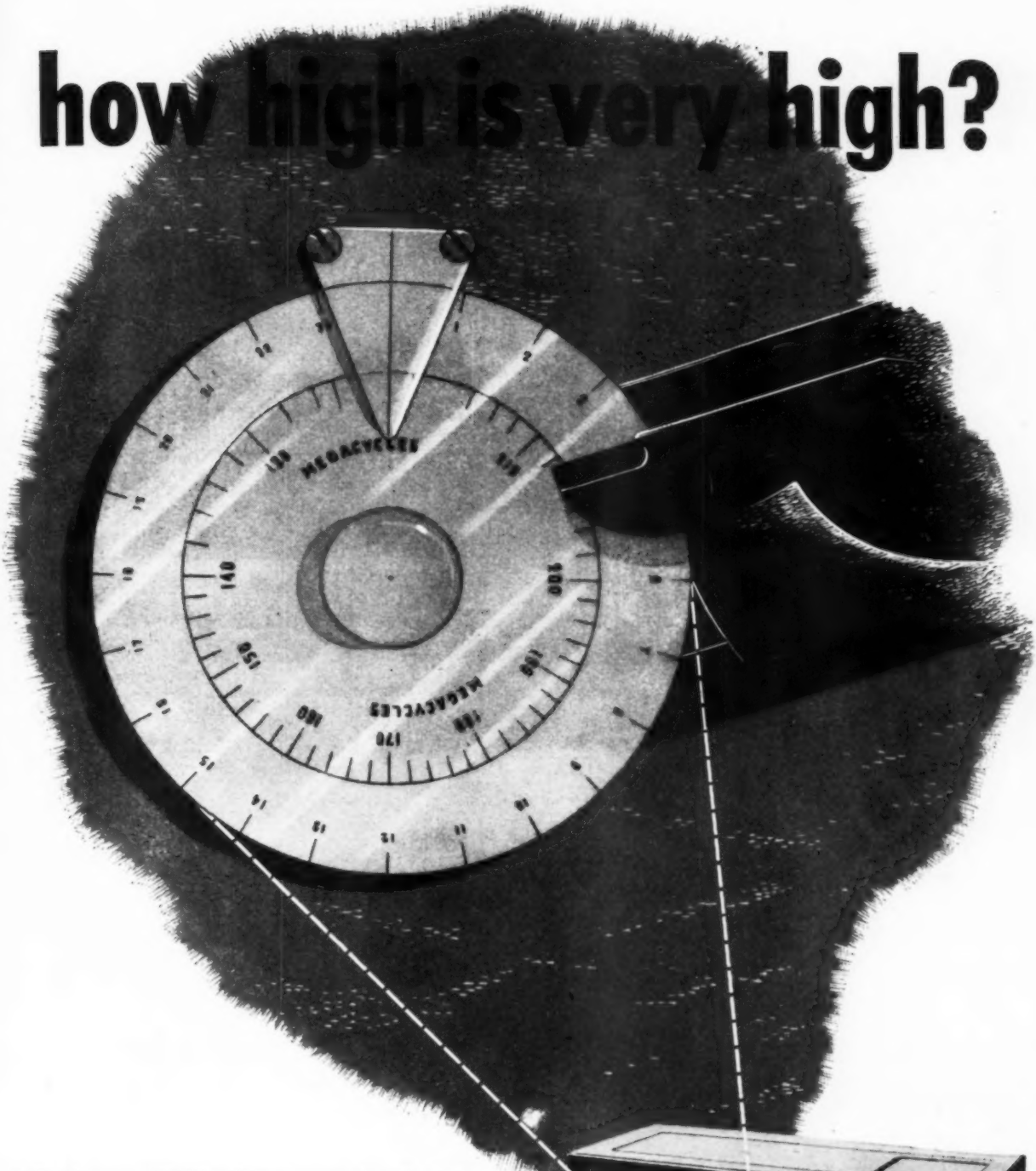
H. G. STRONG
Circulation Director

H. J. MORGANROTH
Production Director

Copyright, 1945
ZIFF-DAVIS PUBLISHING COMPANY
Editorial Offices: 540 N. Michigan Ave., Chicago 11, Ill.
Member of the Audit Bureau of Circulation

RADIO NEWS is published monthly by the Ziff-Davis Publishing Company at 540 N. Michigan Ave., Chicago 11, Ill. New York Office, Empire State Building, New York 1, N. Y. Washington, D. C. Office, International Building, 1319 F Street, N.W. Washington 4, D. C. Los Angeles Office, William L. Pinney, Manager, 815 S. Hill St., Los Angeles 14, Calif. London Office, Grand Buildings, Trafalgar Square, London, W.C.2. Subscription Rates: In U. S. $3.00 (12 issues), single copies, 35 cents; in Mexico, South and Central America, and U. S. Possessions, $3.00 (12 issues); in Canada $3.50 (12 issues), single copies 40 cents; in British Empire, $4.00 (12 issues); all other foreign countries $6.00 (12 issues). Subscribers should allow at least 2 weeks for change of address. All communications about subscriptions should be addressed to: Director of Circulation, 540 N. Michigan Ave., Chicago 11, Ill. Entered as second class matter March 9, 1938, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Entered as second class matter at the Post Office Department, Ottawa, Canada. Contributors should retain a copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever adaptations, and revisions, including by-line changes necessary to meet requirements. Payment covers all authors', contributors' or contestants' rights, title, and interest in and to the material accepted and will be made at our current rates upon acceptance. All photos and drawings will be considered as part of material purchased.

how high is very high?



★ Engineers at Hallicrafters are continually striving for new heights of perfection in high frequency development work. The Model S-37 is one example of the progress they have made. This is the first and only set of its kind — covering both AM and FM and operating in the range of 130 to 210 Mc. Two r.f. stages are used and in conjunction with an intermediate frequency of 18 Mc., assure an amazingly high ratio of image rejection. It is becoming a valuable instrument in the hands of all exploring the upper reaches of the high frequency ranges.

Model S-37. The highest frequency range of any continuous tuning commercial type receiver.

hallicrafters RADIO

Buy a War Bond Today!

THE HALLICRAFTERS CO., MANUFACTURERS OF RADIO AND ELECTRONIC EQUIPMENT, CHICAGO 16, U. S. A.

America is the achievement of fearless men who pushed West and West and West despite the cruel hardships, the physical dangers they encountered. But pioneering was not finished with the colonization of the new continent. The same spirit is evident in the improvements Fada has pioneered for 25 years. And still we are not satisfied! That's why you can always look to Fada for the newest and finest in whatever electronic marvels war's end will bring.
PLACE YOUR FAITH IN THE
Radio
OF THE FUTURE
Famous Since Broadcasting Began!
FADA RADIO AND ELECTRIC COMPANY, INC., LONG ISLAND CITY, N. Y.

ALNICO 5 by Jensen

FIFTEEN YEARS AGO, when JENSEN introduced the first Permanent Magnet Loud Speaker in the United States, the magnet itself weighed 98 ounces (6.1 pounds)—a bulky, costly structure . . . but, still an outstanding *first* by JENSEN. ¶ By 1940, through advanced design and without decreasing the magnetic strength, JENSEN had reduced the weight of the magnet for an equivalent speaker to 21 ounces! ¶ Now, with ALNICO 5 the most powerful magnet material ever developed, JENSEN is able to obtain the same magnetic strength as in the original 1930 design with a magnet weighing only 4.64 ounces, giving compactness and light weight *with* highest efficiency.

Jensen

SPEAKERS WITH ALNICO 5

Specialists in Design and Manufacture of Acoustic Equipment

JENSEN RADIO MANUFACTURING COMPANY, 6601 SOUTH LARAMIE AVENUE, CHICAGO 38, ILLINOIS

AUDAX
RELAYED-FLUX
Microdyne

Long before this war began AUDAX PICKUPS were in

SELECTIVE SERVICE

Since pickups first became important commercially, the distinguished products of AUDAX have been SELECTED wherever and whenever the requirements were exacting.

Today AUDAX magnetically powered pickups are SELECTED for War contracts that demand the highest standards of performance, regardless of climatic variations or severe handling.

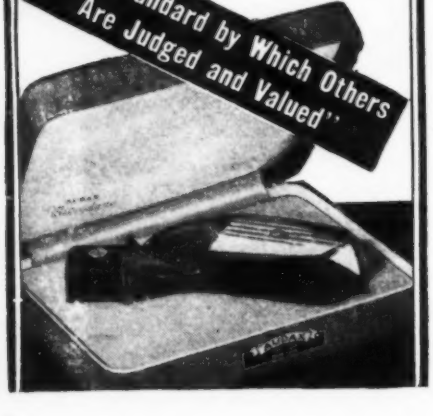
Our stern peacetime standards, maintained for so many years, have proven comfortably adequate to meet government specifications.

The sharp, clean-cut *facsimile* reproduction of MICRODYNE is a marvel to all who have put it to the only test that really matters . . . the EAR TEST.

AUDAK COMPANY
500-N Fifth Ave., New York 18, N.Y.
"Creators of Fine Electronic-Acoustical Instruments Since 1915"

Send for your copy of our informative "PICK-UP FACTS"

★ BUY WAR BONDS



FOR THE RECORD

by the editor

WHEN the FCC proposed the frequencies in the 460-470 mc. portion of the radio spectrum for the use of Mr. and Mrs. Citizen, it opened a tremendous potential market for the makers of ultra-compact dry batteries.

The newspapers have been ballyhooing this "Citizen's" band, pointing out the tremendous possibilities for such civilian communications. They have emphasized that the "walkie-talkie" would be used by farmers, doctors, etc. There still is considerable confusion in the minds of the public as to the physical difference between the "walkie-talkie" and its baby brother, the "handie-talkie." Radio dealers should point out to those making inquiry that there is a great difference between the two units. For example, the "walkie-talkie" is 17 inches high, 12 inches wide and 7 inches thick in comparison with the "handie-talkie" which measures 3x3x12 inches long. The latter weighs but slightly more than five pounds, while the larger unit tips the scale at approximately thirty-five pounds.

Which brings us to the matter of range. The "handie-talkie," due to its small transmitting power, can only be used for very short-range communications. Operating entirely by means of ultra-compact batteries, service life is limited. When used for both sending and receiving messages, these batteries will have a life of approximately twelve hours. If used for receiving only, they will last more than fifty hours.

On the other hand, the "walkie-talkie" produces considerably more power and has a greater range, but is certainly not the "personal" type of two-way unit.

Manufacturers are quick to point out that the very first sets produced for the Citizen should operate from central power sources or from a six-volt storage battery. Later on, as dry batteries are further developed and more efficient ultra-compact tubes can be produced, only then will the "handie-talkie" have universal appeal. When these tiny sets are produced, dry battery makers can expect some heavy production. Radio dealers and other merchandisers will have an excellent replacement battery business. In addition, service will be required on the radio units and the service technician will be faced with the necessity for having a comprehensive knowledge of u.h.f. and v.h.f. technique. Special service equipment will be required to cover the new frequencies. In order to use this equipment intelligently, the aggressive serviceman will do well to begin now to study the behavior of these new frequencies.

Tremendous strides have been made during this war in the development of batteries for the above mentioned sets. Our Chief Signal Officer, Major General Harry C. Ingles, has often pointed out the necessity for better and better dry batteries. In the early stages of the war it was found that a high percentage of all dry batteries shipped to combat zones arrived in such a condition that they were not of any use. He told us, too, on the other hand, that American engineers were quick to solve this problem and today we find that longer life and smaller dry batteries have resulted in a far more dependable unit to keep our vital communications intact.

WIDESPREAD interest has been indicated in many letters received recently from our readers on the subject of potential employment with the Radio Intelligence Division and the Foreign Broadcast Intelligence Service division of the FCC. Interested persons should send their full qualifications directly to the Federal Communications Commission, Washington, D. C. Postwar functioning of these branches will depend largely upon public and commercial needs.

OUR friend George Sterling, Chief of the RID, brought up the following when we visited him recently—several WERS operators have been creating interference to vital communications by operating various types of "radiating" direction finders. Mr. Sterling urged that such practice be discontinued. The RID has intercepted many such signals in recent months. WERS—pse note!

LETTERS are still being received from our servicemen readers giving their opinions on the matter of licensing radio service technicians. Many letters have been reproduced in RADIO NEWS. In analyzing the situation, it appears that the greatest need is for "organizing" rather than an alternate of direct licensing. We have found that several organizations have, for the most part, been able to solve completely most of their problems and in all cases have added to the prestige of their memberships.....O.R.

Fast, Reliable Source for Leading Makes of

INDUSTRIAL ELECTRONIC INSTRUMENTS

For Measurement, Inspection, Testing and Control

● Allied's concentration of leading makes *under one roof* means you can obtain the type of instrument you want . . . *in the shortest time possible.* This specialized service to industry, government, and research laboratories simplifies procurement . . . increases efficiency . . . saves hours, days, and effort. Such well known makes as RCA, Dumont, G.E., Industrial Instruments, Hickok, Radio City, Triplett and others. Many on hand for immediate delivery. *Save time and work . . . Call Allied First!*

Helpful BUYING GUIDE Sent on Request

WRITE, WIRE OR PHONE HAYMARKET 6800

TUBE TESTERS
OSCILLOSCOPES
CAPACITY DECADES
RESISTANCE DECADES
WHEATSTONE BRIDGES
RESISTANCE LIMIT BRIDGES
WEIN CAPACITY BRIDGES
SIGNAL GENERATORS
PANEL METERS
VACUUM TUBE VOLTMETERS
VOLT-OHM-MILLIAMMETERS

EVERYTHING IN ELECTRONICS AND RADIO

● It's faster, simpler to get all your electronic and radio supplies from this one central source. We carry the largest and most complete stocks of parts and equipment under one roof . . . ready for immediate shipment. Besides, our procurement experts are in constant contact with all leading manufacturers to speed supplies.

ALLIED RADIO
CORPORATION

833 W. Jackson Blvd. • Dept. 1-DD-5 • Chicago 7, Illinois

SUPPLIERS OF ELECTRONIC PARTS AND EQUIPMENT TO INDUSTRIAL AMERICA

Electronic Tubes, Rectifiers, Power Supplies, Intercommunicating Systems, Sound Systems, Photo-Cell Equipment, Batteries, Chargers, Converters, Generators, Supplies for Resistance Welders, Fuses, Test Instruments, Meters, Broadcast Station Equipment, Relays, Condensers, Capacitors, Resistors, Rheostats, Transformers, Switches, Coaxial Cable, Wire, Soldering Irons, Microphones, Speakers, Technical Books, etc.

BUY MORE WAR BONDS

If you want the job done right —

A group of Hytron engineers decided in 1938 that to get those ideal tubes for "ham" radio — they must build them themselves. Combining years of experience in tube manufacture with exact knowledge of the tube characteristics desired, they went to work.

First they concentrated their efforts. Low and medium power types were most needed by the majority of hams. Hytron was equipped to make them. Gradually the engineers translated ideals into a comprehensive line—v-h-f triodes and pentodes, low and medium mu triodes, instant-heating r.f. beam tetrodes, and sub-miniatures.

Hams themselves, the engineers knew their brain children would be given the works. They built the tubes rugged; rated them conservatively. And did the amateur go for them! The v-h-f types — HY75, HY114B, HY615 — soon became accepted standards. Today's WERS operators use them almost exclusively.

Performance in the proving ground of amateur radio was the proof of the pudding. You will find Hytron transmitting and special purpose tubes in war and civilian jobs of all kinds. Like the BANTAM GT and BANTAM JR., they are popular because they are built right for the job.

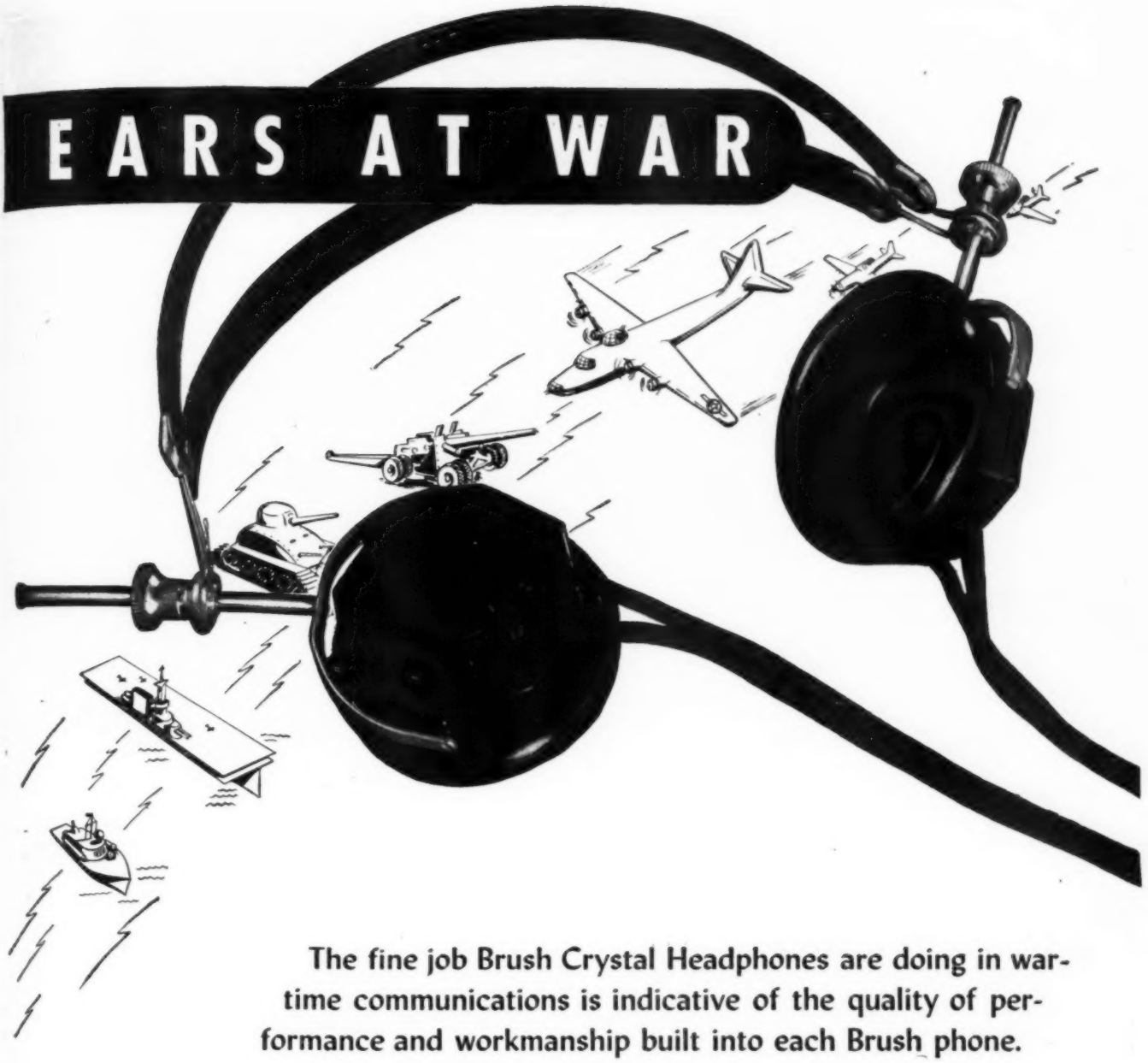
OLDEST EXCLUSIVE MANUFACTURER OF RADIO RECEIVING TUBES

HYTRON

SALEM AND NEWBURYPORT, MASS.

BUY ANOTHER WAR BOND

EARS AT WAR



The fine job Brush Crystal Headphones are doing in wartime communications is indicative of the quality of performance and workmanship built into each Brush phone.

Features of Brush Crystal Headphones are—

- **Wider range—clarity at all frequencies from 100 to 10,000 c. p. s.**
- **High impedance—ideal for multiple installations.**
- **BIMORPH* crystal drive element.**
- **High sensitivity.**
- **Light weight, rugged, shock-proof construction.**

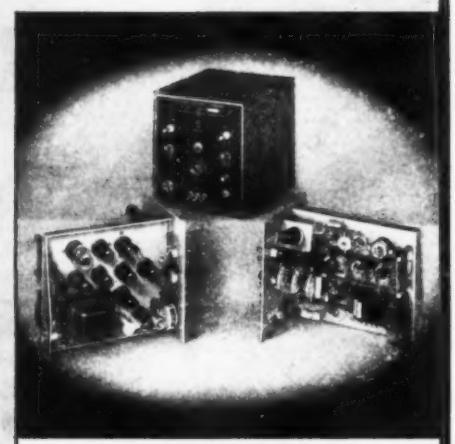
*Trade Mark Reg. U. S. Pat. Office

THE BRUSH DEVELOPMENT COMPANY

3463 PERKINS AVENUE • CLEVELAND 14, OHIO

Designed for

Application



THE No. 90505

SECONDARY FREQUENCY STANDARD

A Precision Frequency Standard for both Laboratory and production uses. Designed around the GE crystal, having a frequency temperature coefficient of less than 1 cycle/Mc/C°. The crystal is sealed in a standard metal tube envelope. Adjustable output provided at intervals of 10, 25, 100, and 1000 KC with magnitude useful to 50 MC. Harmonic amplifier with tuned plate circuit and panel range switch. 800 cycle modulator, with panel control switch. Panel plate supply control switch. In addition to Oscillators, Multi-vibrators, Modulators, and Amplifiers, a built-in Detector with 'phone jack and gain control on the panel is incorporated. Self-contained AC power supply with VR 150-30 voltage regulator. Cabinet size 9" x 9⅝" x 10½", weight 20 lbs.

JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

MALDEN

MASSACHUSETTS

Spot Radio News

By RADIO NEWS Washington Correspondent

Presenting latest information on the Radio Industry.

FREQUENCY ALLOCATIONS AGAIN were in the spotlight in February when the all-important industry hearings on the FCC proposal began. Originally scheduled for the early part of the month for a one- or two-day session, the hearings were postponed until the latter part for quite an extended session, because of repeated requests from several sections of the industry for more study and preparation time to present oral arguments for proposal changes. The FM interests were the most prominent in this group. Statements issued by Walter J. Damm, president of FMBI (FM Broadcasters, Inc.) and Commander E. F. MacDonald Jr., president of Zenith Radio, were quite critical of the Commissions' decision to shift the FM broadcasting band from its present region of 42 to 50 megacycles to the new band of 84 to 102 megacycles.

Commander MacDonald stated that the suggested change would cancel out most of the industry's experience in that band and delay expansion for at least a year. He proposed a modification of the shift in frequencies, by starting FM at 40 megacycles and extending the band to 70. He said that this would overlap the present band enough to make room for all existing FM stations and prevent complete obsolescence of receivers now in use. In addition, Commander MacDonald claimed that the change would provide FM with the additional channels it needs.

Mr. Damm's statement also protested the Commission's proposed changes. His views on the exact frequencies that he believed FM should have were contained in a letter to J. R. Poppele, president of TBA (Television Broadcasters Association). He declared in this letter that his company, the *Milwaukee Journal*, was opposed to any stand that the television broadcasters were taking in favor of the proposed frequencies. He based his views, he said, on experiments that his engineers had conducted between 1931 and 1938 on 43 to 46 megacycles. Mr. Damm proposed that FM be assigned to the 46 to 64 megacycle channel and that the No. 1 television channel should be from 70 to 76 megacycles; television channel 2, 78 to 84 megacycles; channel 3, 84 to 90; channel 4, 90 to 96; channel 5, 96 to 102; and channel 6, 102 to 108 megacycles. Mr. Damm also indicated in this letter that the Yankee network, which is a member of the TBA, concurred in these views.

FCC officials disclosed that they were still of the belief that FM should go to the higher frequencies. They declared, however, that they had an open mind on the subject and would not make any definite decision until the hearings were completed. Evidence of this opinion also appeared in Commissioner E. K. Jett's statement before a House subcommittee conducting hearings on the Independent Offices Appropriation bill. This bill concerns allotments to various government agencies. Commissioner Jett indicated during his testimony that he felt that FM should be moved up to higher frequencies, to avoid interference problems. He stated that the Commission had based their opinions on very authoritative data and therefore believed that the higher frequencies were really the place for FM. However, he stated that he was certainly willing to listen to any evidence that might be submitted to alter this view. Commenting on the claims that close to a half-million sets would be obsoleted by the change in frequencies, he said that most of the receivers are combination AM and FM receivers and would still be capable of receiving the AM band. In addition, he said any change toward the higher frequencies (and such changes were even being suggested by the FM industry specialists) would obsolete the receivers insofar as FM were concerned, these receivers would only be good in certain communities within the tuning range of the station in that community.

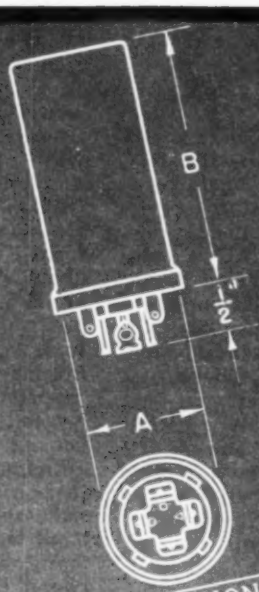
All were not in complete disagreement with the FCC FM proposal. For instance, Ira Hirschmann, vice-president of Metropolitan Television disclosed that he had written to the FMBI directors and indicated complete approval of the FCC proposal. He said that he was strongly for the final adoption of the proposed changes and would not side with the FMBI in their dissenting view. Several receiver manufacturers also approved of the FCC allocations. Included in this group were William J. Halligan, president of Hallicrafters, who said that the 42- to 52-megacycle band was known to be subject to intereference. He based his opinion on experience of mobile police operating between 30 and 40 megacycles, and amateur radio which operated on 56 to 60 megacycles. Many reports of interference on even low powers were received on these frequencies he declared. Above 80 megacycles such interference was practically nonexistent, according to Mr. Halligan. Mr. Halligan cited his views in a letter to FCC chairman Paul A. Porter.

MEMO TO *Purchasing Dept.*

For postwar, recommend we standardize on Solar's hermetically-sealed, patented special twist-prong base Type DY electrolytic. They're properly protected against moisture.

E.M.

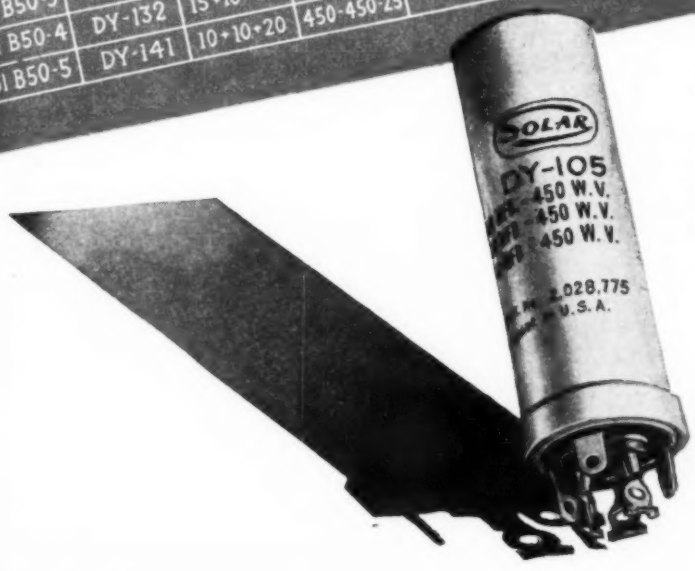
ENGINEERING SPECIFY Solar DEPARTMENT



PART NO.	SOLAR PART NO.	CAP'Y MFD.	WKG. VOLTS	DIMENSIONS "A"	DIMENSIONS "B"
51 B50-1	DY-61	20+20	150	1"	2"
51 B50-2	DY-92	20+20	450	1"	3-3/8"
51 B50-3	DY-94	10+10	450	1"	2-½"
51 B50-4	DY-132	15+10+20	350-350-25	1"	2-½"
51 B50-5	DY-141	10+10+20	450-450-25	1"	3"

LEADING MANUFACTURERS EVERYWHERE

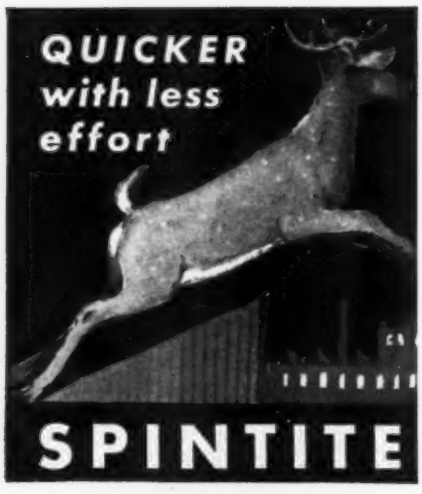
		DATE	1/4/45
DRAWN	E.U.H.	DWG. No.	51 B50
TRACED	M.	ISSUE	
APPROVED	J.C.		



Prominent engineers consistently show their preference for Solar Capacitors. Solar pledges continued production of superior quality capacitors to merit that preference. Solar Manufacturing Corporation, 285 Madison Avenue, New York 17, N. Y.

ARMY E NAVY

SOLAR CAPACITORS & ELIM-O-STATS



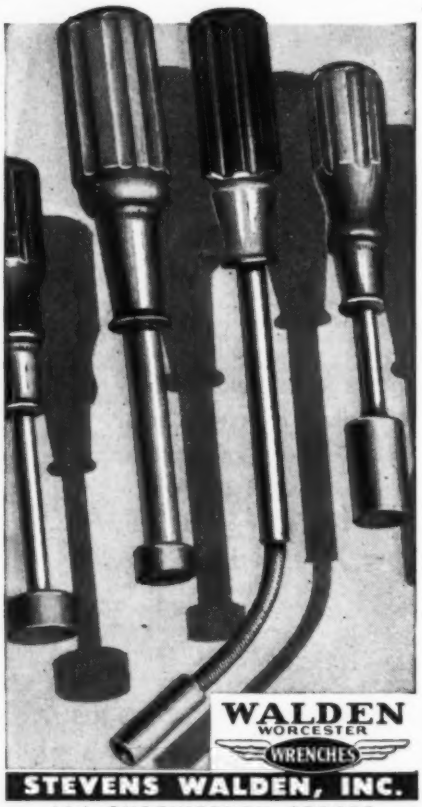
SPINTITE

WRENCHES

are going over in a big way on long assembly lines, where small, square, hexagon or knurled nuts are used.

Special SPINTITES with Flexible Shank for inaccessible places.

Send for Catalog No. 141 illustrating a full line of wrenches for Radio, Aircraft and Automotive Tools.



STEVENS WALDEN, INC.
464 SHREWSBURY STREET
WORCESTER, MASSACHUSETTS

The higher frequencies were also approved by engineers of the Belmont Radio Corporation who declared that bursts were quite serious on the lower frequencies and cause interference. They declared that now is the time to decide which is the proper channel to use to provide for the best service. Any plans that might have been made are worthwhile scuttling, they stated, if the new proposals will really solve all the problems.

The allocations were also approved by several other groups which included emergency communications, relay systems, transit utilities, aeronautical radio, forestry conservation and the ARRL. In a letter of approval to the FCC, Herbert A. Friede, chairman of committee 2 of RTPB panel 13 covering the emergency services, declared that the Commission had adopted a sound forward-looking policy offering great encouragement to all communications engineers of the fire and police emergency services.

At this writing about 25 had scheduled an appearance before the FCC to discuss the allocations. Included in this group were: CBS; RCA and its affiliates, NBC, Radio Marine Corporation of America, and RCAC; Cowles Broadcasting Co.; Subscription Radio; American Trucking Association; Association of American Railroads; National Association of Motor Bus Operators; Independent Telephone Association; Aireon Manufacturing Co.; U. S. Office of Education; NAB; FMBI; and Yankee Network. The FMBI group was scheduled to have Walter J. Damm; Ray H. Manson and George R. Towne of Stromberg-Carlson; W. R. David of GE; and Commander E. F. MacDonald Jr. of Zenith, appear in their behalf.

As this column is being written, the hearings are still in progress and thus an analysis of the final decisions will be offered next month.

THE IRE WINTER MEETING AT THE COMMODORE HOTEL, NEW YORK CITY was also the scene of heated debates on FM allocations. The debates, provoked by a paper on "Very-High Frequency and Ultra-High Frequency Signal Ranges as Limited by Noise and Co-channel Interfence," presented by E. W. Allen Jr., special engineer for the FCC, covered a two-hour session in one day and a three-and-half-hour session another day. In the first day's debate Mr. Allen and Major E. Armstrong were involved, while the second session included many experts; Allen B. DuMont; Dr. T. T. Goldsmith of DuMont Laboratories; Dr. H. H. Beverage of RCA Laboratories; Professor D. Noble of Motorola; Dorman Israel of Emerson Radio; Dr. Harlan P. Stetson of MIT; C. M. Jansky, Jr., chairman of the RTPB FM panel; Mr. Hackbusch of the Canadian IRE; John D. Reid of Crosley; Dr. K. A. Norton (who originally prepared the paper read by Mr. Allen); and Mr. Allen and Major Armstrong.

Commenting on the debate which his paper had caused, Dr. Norton said that FM must use the higher frequencies if it is to provide a satisfactory service to the public. Major Armstrong indicated that practical experience did not support the theoretical conclusions offered by Dr. Norton's paper. He said that his experience showed that there isn't much F2 interference around 50 megacycles. He supported this by referring to the 1936-7 sunspot period when NBC was conducting experimental FM broadcasts on 49.5 mc. No interference was noticed in the 50-60-megacycle region during this time, he said. Mr. Allen then declared that on several occasions television signals had been received from English stations on 50 megacycles in many spots on Long Island. He called the North Atlantic path a notoriously low-frequency one. Dr. Beverage supported this conclusion by revealing his sunspot observations in 1927 on 50 megacycles. He said that harmonics of many South American stations were received on this band. And in 1937 to 1938 he, too, had received the television station from Alexandra Palace in London. He also reported reception of signals from French and German Stations at about 45 megacycles. He said that at 41.5 megacycles the sound channel was received better than television. Checking with the Bureau of Standards on this result, Dr. Beverage reported that this long-distance reception was prompted by the F2 layer. During these tests he used a rhombic antenna 45 feet above ground and 200 feet on the side. Professor Noble also indicated that the 35-to-40 megacycle band was a source of interference in many tests that he had conducted between police stations. He said that in a period of three months the Michigan State Police had experienced severe interference from stations in Alabama. Some times the signal levels were as high as 500 microvolts, he said. He was strongly in favor of the higher frequencies. Dr. T. T. Goldsmith and DuMont concurred in this opinion. Dr. DuMont told of his tests on 83 megacycles with interference practically nonexistent. He said that during the past years they had picked up television signals from Philadelphia in Montclair, N. J. on 66 to 76 megacycles, but it was not possible to hear Chicago on this frequency. He reported that a 15-microvolt signal provides interference on FM, whereas for television interference levels of from 50 to 100 microvolts are required.

Receiver engineers Israel and Reid discussed the design problems involved in low- and high-frequency bands. Mr. Israel said that the tuning range from 40 to 75 megacycles which had been proposed by several in the industry, was 1.75 to 1, while the tuning ranges proposed in the FCC assignment was 1.39 to 1. Discussing conversion of present receivers to the higher frequencies, Mr. Israel said that it is difficult but not impossible. The higher-frequency receiver, accord-

PREPARE NOW FOR THAT BETTER JOB IN RADIO ELECTRONICS

Above: Working out experiments Nos. 1, 2, 3, 4—after receiving Kit No. 7.

DeForest's Training is an effective, interesting stepping-stone toward good jobs, good pay. By actually using Radio parts and assemblies to build experiments described in your Loose-Leaf Lessons, you "LEARN-BY-DOING"—by using Home Movies to bring Radio's fundamentals to life in your own home, you "LEARN-BY-SEEING." You get BOTH features with DeForest's.

BUILD THIS "SUPER-HET"

DeForest's unique "*Block System*" makes assembling this Superheterodyne and many other Radio-Electronic circuits—simple and easy. In fact, you work out—

. . . 133 INTERESTING EXPERIMENTS USING THESE RADIO PARTS

PREPARE FOR A FIELD RICH IN PRESENT AND FUTURE OPPORTUNITIES

Just Consider—in the U. S. there are around 50 million Home Radios, 7 million Car Radios—900 Broadcast Stations—6,000 Police Transmitters—30,000 Retail Radio Outlets and 1,000 Radios and Radio Parts Manufacturers. Think of the number of Trained men needed in a field This Size! Then—think of the expanding fields of "FM" Radio, Motion Picture Sound and other new and interesting branches of the Electronics industry. Isn't it reasonable to believe that Tremendous Future Opportunities exist for Trained men and women? Can't you see yourself climbing the ladder of success toward a Good Pay Job, or in a Sales and Service Business of your own in this newer, expanding industry? Get the Facts about this great field of Radio Electronic opportunities! Mail the Coupon—Now!

SEND FOR BIG FREE BOOK

Write today for DeForest's Big, Free Book, "Victory For You!" See what the growing Radio-Electronic field offers you—and How DeForest's prepares you at home in your spare time without interfering with your present job. Get complete facts about DeForest's exclusive "A-B-C" combination of home training advantages that includes (A) the use of 8 big kits of Radio parts and assemblies, (B) the use of a genuine DeVry Movie Projector and 12 reels of training film revealing hidden circuit actions, (C) 90 well-illustrated loose-leaf lessons prepared under the supervision of Dr. Lee DeForest, often called the "Father of Radio"—Plus an effective Employment Service that has long-established contacts with many employers. You "Learn-by-Seeing" . . . you "Learn-by-Doing" . . . you *GET RESULTS AT HOME*. . . the modern DeForest's Way. You be the judge.

"LEARN-BY-DOING" AT HOME!

With Standard Radio Parts furnished by DeForest's, you construct and operate 6 different types of Radio Receiving circuits—a Radio Telephone—Public Address System—Electric Eye devices—Wireless Microphone—Light Beam Transmission and many other projects—all in Your Own Home. Set up your own Electronic Laboratory. Enjoy this *fascinating* way to learn.

LEARN BY *SEEING*—AT HOME!

DeForest's Home Movies Help You Learn Faster—Easier at Home

SEE Radio Circuits in Action . . Electrons on the March—with this genuine DeVry projector and training films.

DeFOREST'S TRAINING, INC.
CHICAGO 14, ILLINOIS

DeFOREST'S Training also offers instruction in Motion Picture Sound Equipment, FM Radio and Television

E. B. DeVry, President
DeFOREST'S TRAINING, INC.
2535-41 North Ashland Avenue, Dept. RNB4
Chicago 14, Illinois, U. S. A.

Please send me your "VICTORY FOR YOU" book and KIT FOLDER, FREE.

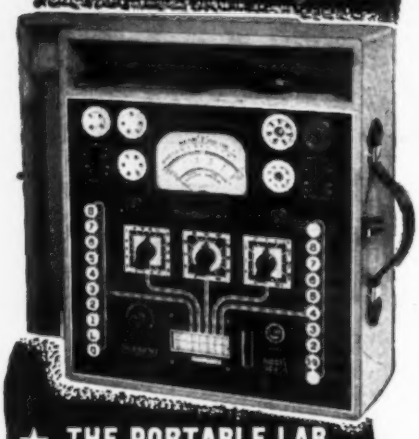
Name..... *Age*....

Address .....

City..... *State*.....

☐ If under 16, check here for special information.
☐ If a veteran of World War II, check here.

MODEL 504-A
Tube and Set TESTER....



★ THE PORTABLE LAB THAT GIVES YOU—
Everything!

★ Design proven by over 5 years production of thousands of this model.

★ Operation as simple as ABC. Multisection push-button switches do all work. Simply "follow the arrows" for tube checking. No roaming test leads for the multimeter.

★ Open face wide scale 4¼-inch rugged meter built especially for this tester—500 microampere sensitivity.

★ Each AC and DC range individually calibrated.

★ Professional appearance. Solid golden oak carrying case.

★ Guaranteed Rectifier.

SPECIFICATIONS

DC MICROAMPERES:
0-500

DC MILLIAMPERES:
0-2.5-10-50-250

DC AMPERES
0-1-10

DC VOLTS—1000 OHMS PER VOLT:
0-5-25-100-250-500-1000-2500

AC VOLTS
0-5-10-50-250-1000

OUTPUT VOLTS:
0-5-10-50-250-1000

OHMMETER:
0-200-2000-20,000 OHMS
0-2-20 MEGOHMS

BATTERY TEST:
Check Dry Portable "A" and "B" Batteries Under Load

CONDENSER CHECK:
Electrolytics checked on English Reading Scale at Rated voltages of 25-50-100-200-250-300-450 volts.

TUBE TESTER:
Emission type with noise test, floating filaments, easy chart operation. Checks all receiving type tubes.

POWER SUPPLY:
115 volts 60 cycle. Special voltage and frequency upon request.

SUPREME
SUPREME INSTRUMENTS CORP.
Greenwood, Miss., U.S.A.

ing to Mr. Israel, would cost more than the lower-frequency models. Mr. Reid agreed with Mr. Israel, adding that FM receivers are more expensive anyway because of the adjacent channel selectivity factors involved. He indicated that at least 10 tuned circuits are required to provide the necessary selectivity and also provide for reception of signals varying from .5 to 50 microvolts. Receivers with multituned circuits also present noise susceptibility problems between adjacent channels cited Mr. Reid.

Dr. Jansky stated that the cost of receivers was not the all-important factor involved in the frequency allocation dispute. He said that it is essential that we establish the facts and interpret them accurately. He pointed out that when panel 5 of the RTPB discussed interference problems with Dr. Dellinger of the U. S. Bureau of Standards, Dr. Dellinger replied that no radio frequencies are free from transmission vagaries. Dr. Jansky indicated, however, that he is perfectly willing to concede to moving to the higher frequency if such a move will absolutely prove to be the best one for the service.

Dr. Stetson of MIT, discussing sunspots, said that frequencies change over an eleven-year cycle due to the sunspot action. The practical results differ from theory at lower frequencies, he emphasized. In 1937, he said, we had the highest sunspot cycle since 1870, but the next one will not be as high. It is therefore necessary, he emphasized, to consider this point very carefully in analyzing the frequency allocations.

FREQUENCY ASSIGNMENTS PROVIDED IN THE FCC PROPOSAL have already prompted some very interesting developments, particularly in the telephone systems. It will be recalled that officials of both independent telephone and the Bell systems discussed various applications of radio links in conjunction with the telephone system. One such proposal covered an emergency message service which would provide for the contacting of people during emergencies by way of radio and telephone links. Calling of physicians enroute in their cars was one of the major features specified for this service. As a result, telephone companies and private interests have begun to study methods of providing such a service. One telephone-answering system is planning to install (provided permission will be obtained) miniature receivers in doctors' cars which would receive pulses that would actuate alarms or lights and notify the car occupant that either he is to call his office, hospital, or the telephone-answering service for further information. Low-powered transmitters covering a 50- or 75-mile radius on AM have been suggested by several engineers.

This service would supplement the citizens' "walkie-talkie" service suggested by the FCC in their allocations proposal. Since quality is not important and size is a factor, many engineers believe that AM equipment will provide for better service than FM. The proposed methods are receiving substantial attention from government and industry engineers and executives. The general consensus is that such a service would be extremely effective and useful in many ways.

PRESENT WAR CONDITIONS AND THE RECENT FCC rulings call for a freezing of all broadcast construction effectively analyzed recently in an unusual talk by FCC Chairman Paul A. Porter. Speaking before the FCC Bar Association in Washington, he declared that there will be little broadcast-station building until conditions improve.

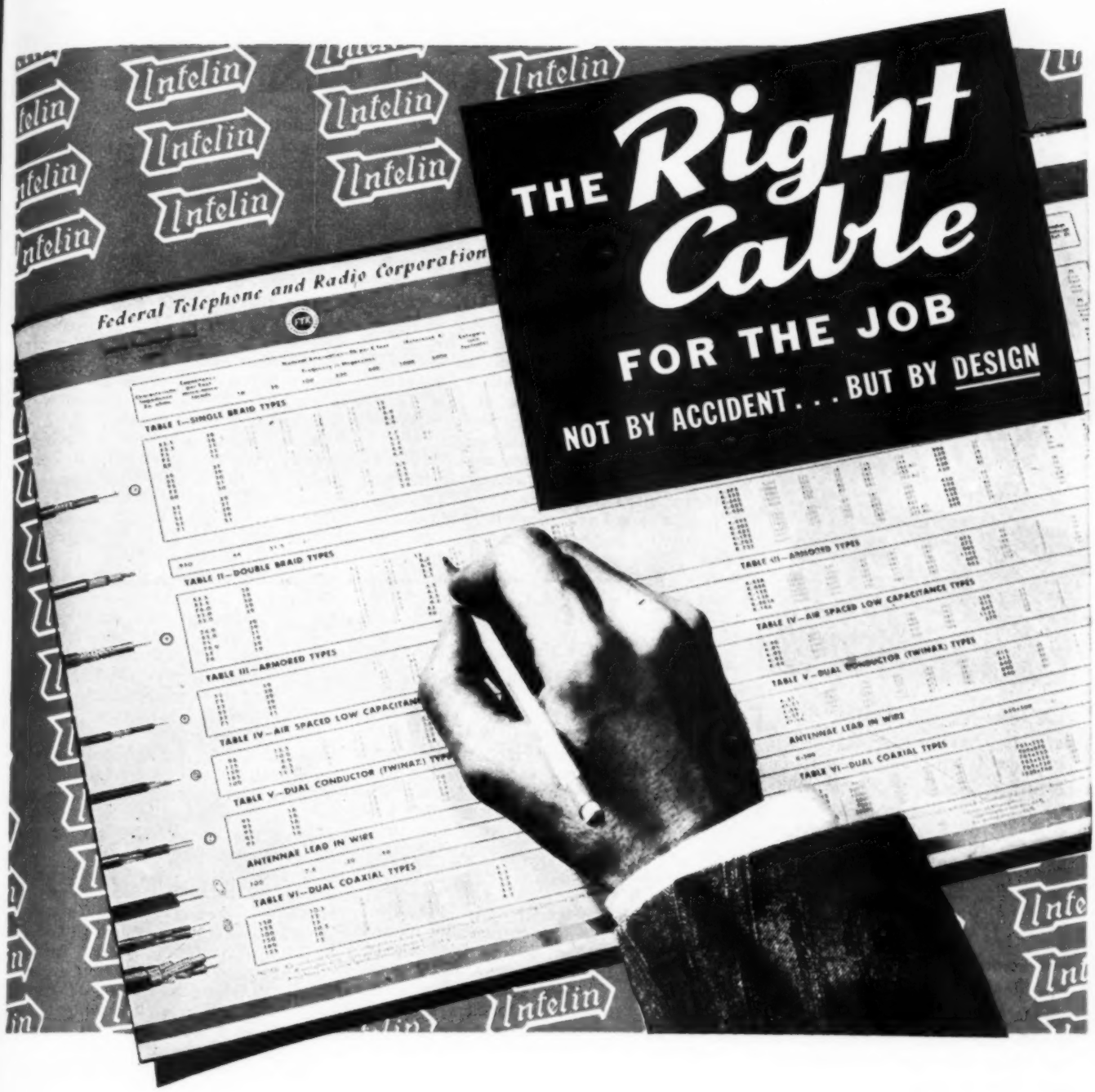
He said that the rigor of the rules may be judged by the fact that of fifteen applications for new stations or changes in facilities considered recently, only five were allowed. Three of these grants were for changes in local channel stations. The other two were for new stations in communities which have no other broadcast stations and have no primary service from any existing stations.

The new ruling does not forbid developmental work. But, emphasized Mr. Porter, the granting of developmental licenses is not to be construed as a loophole in the general freeze order. Experimental or developmental applications are being granted only where bona fide exploration on new techniques or devices, which give promise of adding to the general knowledge of the art, is involved. He pointed out that there is a real need for experiment and development in the higher frequencies with respect to both FM and television. And for such work the FCC and the WPB will provide for the maximum amount of cooperation in the granting of licenses.

In view of the many questions that have been received by the FCC inquiring about how the "pending file" of applications for FM and television will be judged in granting licenses, Mr. Porter issued an explanatory statement during his talk.

He said . . . "Applications are accepted for the pending file where they will remain until the manpower and materials situation permits actual construction. At that time due notice will be given to all concerned and in an orderly manner all applications will be processed and acted upon. FM and television grants will *not* be made on a first-come first-served basis. We hope that in most communities there will be enough channels for all qualified applicants; where that is not the case, grants will be made after hearing to those best qualified . . . not to those under the wire earliest."

"THE STORY OF RADIO IS THE CHRONICLE of American life and times during the past quarter century." So said J. Harold Ryan president of the National Association of


THE Right Cable
FOR THE JOB
NOT BY ACCIDENT . . . BUT BY DESIGN
Intelin
Federal Telephone and Radio Corporation
TABLE I—SINGLE BRAID TYPES
TABLE II—DOUBLE BRAID TYPES
TABLE III—ARMORED TYPES
TABLE IV—AIR SPACED LOW CAPACITANCE TYPES
TABLE V—DUAL CONDUCTOR (TWINAX) TYPES
ANTENNAE LEAD IN WIRE
TABLE VI—DUAL COAXIAL TYPES

To assist the equipment designer Federal offers comprehensive data on high frequency cables.

This technical information sheet provides the design-engineer with pertinent electrical and physical characteristics...including impedance, capacitance, attenuation, diameter, materials, and weight ... for Federal's wide variety of high-frequency cables.

Single and double braid, armored, dual conductor and dual coaxial, air-spaced, low capacitance lines, and antenna lead-in wire . . . there's a right type for your job, backed by the built-in superiority that's a tradition with Federal.

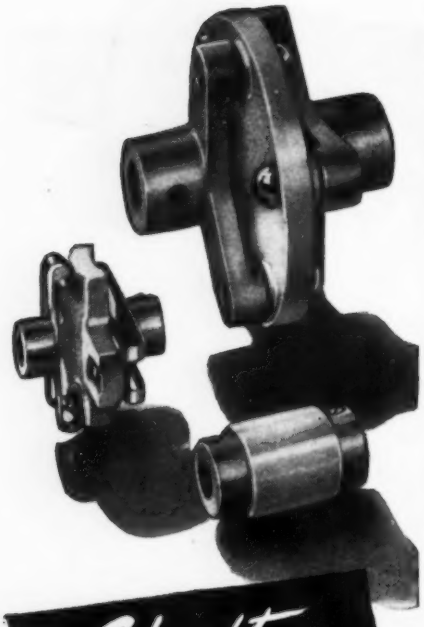
Special developments in flexible low-loss cables by Federal have resulted in superior cables for all types of transmission. For a better job, see Federal first.

Write for your cable information sheet today.

Federal Telephone and Radio Corporation

An IT&T Associate

Newark 1, N. J.



Shaft Couplings

A link between control and variable circuit element, shaft coupling design can be an important factor in proper functioning of electronic equipment.

Illustrated are but three of many Johnson insulated shaft couplings; among them units providing a high degree of flexibility but freedom from backlash common to others resembling them; rigid types where accurate shaft alignment is required and torque may be high; bar types for high voltages or very high frequencies. All are characterized by best steatite insulation properly proportioned for electrical and mechanical strength, by accurate metal parts finished to stand salt spray test, and by those little evidences of Johnson engineering and manufacturing skill that are most appreciated only after use and comparison.

Ask for catalog 968(Z)

JOHNSON
a famous name in Radio

E. F. Johnson Co. Waseca, Minn.

Broadcasters before a Chamber of Commerce meeting at Kansas City, Missouri, in a talk on radio's twenty-fifth anniversary, which is being celebrated this year. He said that we are observing the twenty-fifth year of broadcasting to give renewed and vigorous expression to the American principles which made this miracle of communication possible in a short space of twenty-five years. It was these same principles, he declared, that insured the creation and development of many other models of science and industry; all bound together in spirit through which our nation was so great in peace and is now so formidable in war.

Mr. Ryan disclosed that today 83.7% of all urban radio families use their radios for an average of five hours and four minutes every day, and 88.5% of all rural families listen in for an average of five hours and eighteen minutes per day. According to Mr. Ryan there are more than 31,000,000 homes that have receivers today.

Continuing his discussion of the import of radio to everyone, Mr. Ryan said . . . "Radio has been accorded new respect by men in high places during the last few years. . . . And the people-radio has come to mean more to them in recent years, too. They have a different conception of its mission in the world. They have heard it do terribly important things. It has taken them to inconceivable places and brought them voices and personalities who are changing the shape of the world. . . . The future seems to have a strong pattern. Radio will emerge from this war with the greatest record of public service in its history."

JUNE IS SCHEDULED TO BECOME the all-important radio month of the year. For during that month the third Inter-American radio conference will take place in Rio de Janeiro. At this conference the proposals prepared by IRAC following the August, 1944 conference in Washington and those of the FCC will be presented before a group concerned with involving an international pattern of frequencies. This will be the first of the international meetings which will be followed by a World Conference where the final allocation frequency pattern will be set. The World Conference which, of course, will be held at the conclusion of war, will continue the work of the Berlin, London, Washington, Madrid and Cairo conferences.

In an address before the IRE in New York City recently, Francis C. de Wolf, chief of the Telecommunications Division, Department of State, said that some time in the not-too-distant future we also anticipate holding a conference with representatives of the British Commonwealth of Nations to discuss frequency problems. Commenting on the allocation problems that faced government agencies in 1939, Mr. de Wolf said that there were 3,061 broadcasting stations including standard broadcast, television broadcast, international broadcast and facsimile in this country. And in addition, he said, there were 62,433 non-broadcast stations divided between such services as amateurs, aviation, agriculture, police, ship, relay, and coastal. Incidentally there were over 53,000 amateur stations in 1939 according to Mr. de Wolf.

The last World Conference was held in Cairo in 1938. At the present writing the 1945 Rio conference is set for a two-day session on June 1 and 2.

THE MOVE TO BROADCAST PROCEEDINGS of the House and Senate is active again. Representative Coffee has introduced a House resolution which would provide such a service. The House Committee on Rules is now studying the bill. At the last session of Congress, a similar bill was introduced. However it was set aside by the Committee because of other legislation problems and never did reach a voting stage. Reaction to the bill appears quite favorable.

WPB'S RADIO AND RADAR director L. J. Chatten has returned to his desk after several months of illness. During his absence, Ray Ellis, the former director, was in charge. Mr. Ellis who is with General Motors, will continue to serve WPB as a consultant.

POSTWAR RADIO RECEIVER SURVEYS seem to be sweeping the country. The latest, conducted by a newspaper in Minneapolis, Minnesota, showed that thirty-nine out of every hundred families planned to buy a new receiver, with television if possible. In this group were over 80,000 families. A radio-phonograph combination was the preference of over 65,000, while over 50,000 indicated that they would like to buy a console type receiver. FM did not fare so well in the survey, for only slightly more than 10,000 indicated a preference for this type of receiver. Urbanites were keenest about radio-phonograph combinations. Television and console models were second and third choice selections. However suburbanites placed television as their first choice, with midgets second, and radio-phonographs third. Farmers were also keenest about television, with consoles and phonograph models following along.

An interesting schedule of prices also appeared in the survey. About 45% were willing to spend between $50 and $100 for new equipment; 25% said that they would pay up to $200; 9% felt that they might spend more than $200, and 21% said that they wouldn't spend more than $50.

Covering the equipment now in use, the survey disclosed that 74 in every 100 families have a midget receiver; 49 have a console; 26 an auto set; and 6 a combination receiver.

A survey among dealers from coast to coast by an appliance company also

(*Continued on page* 146)

Here is the one quick practical way to

REALLY LEARN RADIO · ELECTRONICS and TELEVISION

SPRAYBERRY RADIO TRAINING *Gives you Both* -TECHNICAL KNOWLEDGE SKILLED HANDS

..YOU GET A COMPLETE RADIO SET

BE A TRAINED TECHNICIAN

There's only one *right* way to learn Radio Electronics. You must get it through simplified lesson study combined with actual "shop" practice under the personal guidance of a qualified Radio Teacher. It's exactly this way that Sprayberry trains you . . . supplying real Radio parts for learn-by-doing experience right at home. Thus, you learn faster, your understanding is clear-cut, you acquire the practical "know how" essential to a good-paying Radio job or a Radio business of your own.

A Bright Future Ahead

Now's the right time to start training. Because Radio is surging forward, expanding at a rapid pace . . . with the promise of spectacular opportunities in Television, Frequency Modulation, Industrial Electronics . . . in the vast Radio Service and Repair business. When you train with Sprayberry, you need no previous experience. The Course starts right at the beginning of Radio, even shows you how to make spare time profits while learning.

I'll Show You a New, Fast Way to Test Radio Sets without Mfg. Equipment

The very same Radio parts I supply with your Course for gaining pre-experience in Radio work may be adapted through an exclusive Sprayberry wiring procedure to serve for complete, fast, accurate Radio Receiver trouble-shooting. Thus, you do not have one cent of outlay for manufactured Test Equipment, which is not only expensive but scarce. In every respect, my training is practical, complete . . . tested and proved for results. It will give you the broad, fundamental principles so necessary as a background, no matter which branch of Radio you wish to specialize in.

MAIL COUPON NOW !

JUST OUT! FREE!

"How to Read Radio Diagrams and Symbols"

. . . a valuable new book which explains in simple, non-technical English how to read and understand any Radio Set Diagram. Provides the quick key to analyzing any Radio circuit. Includes translations of all Radio symbols. Send for this FREE book now while supply lasts and along with it I will send you another big FREE book describing my Radio-Electronic training.

GET FREE BOOKS

SPRAYBERRY ACADEMY OF RADIO
F. L. Sprayberry, Pres.
Room 2545
Pueblo, Colorado

Please rush my FREE copies of "HOW TO MAKE MONEY IN RADIO, ELECTRONICS and TELEVISION," and "HOW TO READ RADIO DIAGRAMS and SYMBOLS."

Name ..... Age.....

Address .....

City ..... State.....

Tear off this coupon, mail in envelope or paste on penny postcard

"DO NOT SQUANDER TIME"

. . . Benjamin Franklin

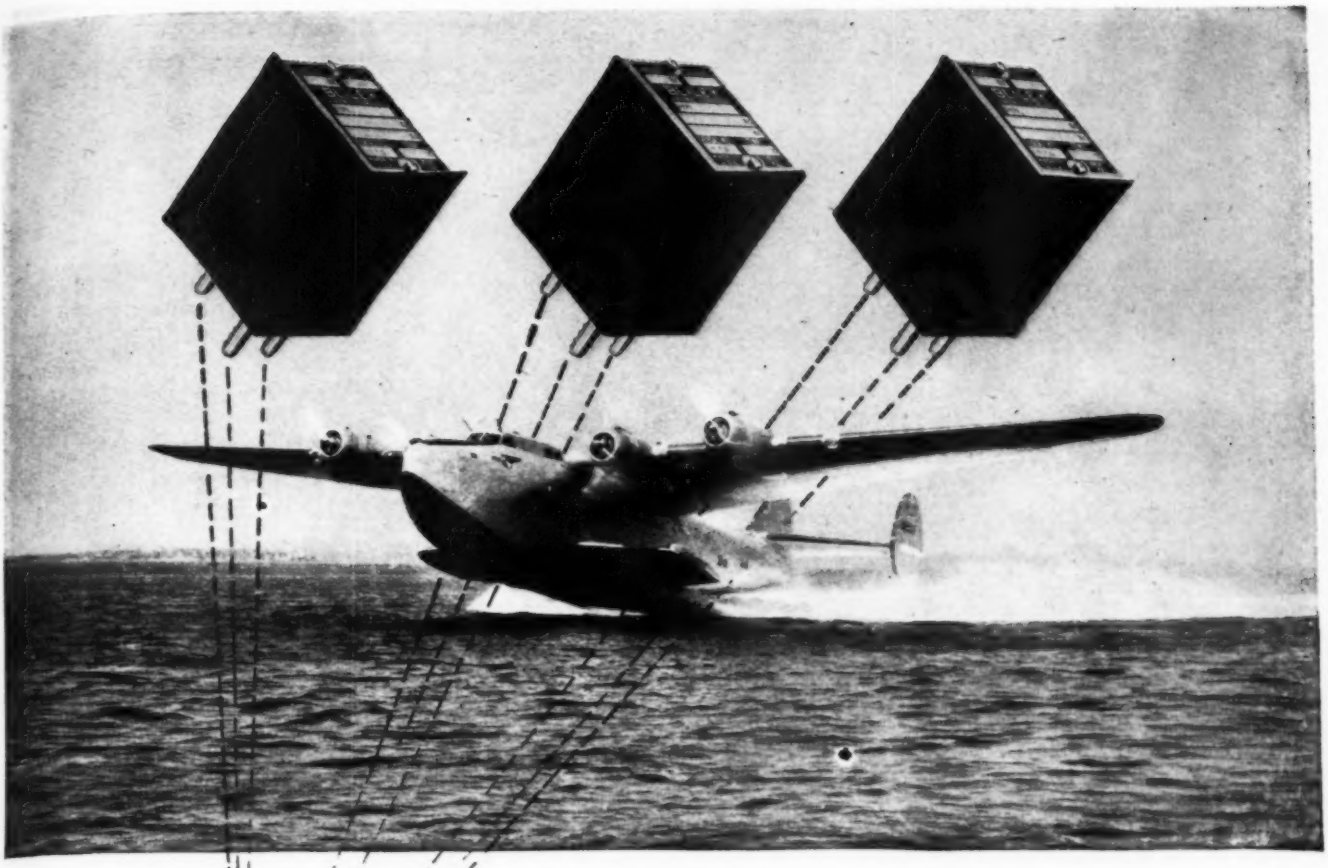
At Connecticut Telephone and Electric Division, production is unhurried, as it must be to maintain accuracy and quality in precision electrical and electronic manufacturing. We substitute *time-saving* methods for *hustle and bustle*. This has enabled us to keep abreast of the ever-increasing need for military communicating equipment of uniform dependability.

After the war, you will very likely use electrical equipment, electronic devices, or communicating systems made at Connecticut Telephone and Electric Division . . . Or you may be one of the many manufacturers who will use our engineering and manufacturing facilities in connection with your own products . . . In either case, our time-saving methods will be your gain, measured by the important standards of uniform high precision, price and speed of filling your orders.

Freshly painted telephone chassis run the gantlet of automatically controlled infra-red dryers, which cut drying time to half an hour. This system, designed by our own engineers, is one of many examples of time-saving installation throughout the Connecticut Telephone & Electric Division plant.

CONNECTICUT TELEPHONE & ELECTRIC DIVISION

GREAT AMERICAN INDUSTRIES, INC. • MERIDEN, CONNECTICUT



BLILEY CRYSTALS, of course, fly with Pan American

Bliley *acid etched** crystals persistently show up wherever there is an important communications job to be done such as the combination two-way telephone and telegraph and range finder systems of Pan American World Airways. In peace and in war Bliley crystals have flown millions of world-wide miles with their famous Clippers.

Bliley crystals are pre-conditioned for just such rugged assignments. In the Bliley Electric Company plant there is a large section where Bliley *acid etched** crystals receive their pedigree. Here each crystal gets "the works". Its activity and frequency are *proved* under tough laboratory created service conditions of altitude, humidity, temperature, immersion, shock and vibration.

But licking tough assignments is a tradition with Bliley engineers and craftsmen. This background of research and skill has been responsible for the distinguished record of Bliley Crystals in every field of radio communication. Whatever your crystal problem may be—specify Bliley.

✣ ✣ ✣

**Acid etching quartz crystals to frequency is a patented Bliley process. United States Patent No. 2,364,501*

☆ *A new star has been added*

ARMY E NAVY

Bliley CRYSTALS

Do more than before . . .
buy extra War Bonds

BLILEY ELECTRIC COMPANY • UNION STATION BUILDING • ERIE • PENNSYLVANIA

A NEW STAR IN THE ELECTRONIC FIELD

EXCELLENCE IN PRODUCTION

The stage is set for something new in Universal's line of products. Next month will bring the appearance of a new microphone to meet markets made by present and postwar demands. This will be the first microphone of its kind offered by Universal since the War. Universal has, since before Pearl Harbor, been manufacturing microphones and electronic voice communication components for the U. S. Army Signal Corps.

We are still pleased to manufacture all the microphones our fighting men require and we are pleased to make a new microphone to fill their and essential home front needs.

← **Emblems of quality in war production**

UNIVERSAL MICROPHONE COMPANY
INGLEWOOD, CALIFORNIA

FOREIGN DIVISION: 301 CLAY STREET, SAN FRANCISCO 11, CALIFORNIA •• CANADIAN DIVISION: 560 KING STREET WEST, TORONTO 1, ONTARIO, CANADA

CONTROLS FOR WORLD MARKETS

Ward Leonard Controls have an enviable record of performance in war equipment. On the sea, under the sea, on the ground, and in the air — subjected to widely varying climatic conditions in all parts of the world!

Obviously manufacturers who are planning world-wide postwar markets can be certain that the Ward Leonard controls they incorporate in their products will give continuous trouble-free service.

Write for our catalogs describing the types of controls you need.

RELAYS—light, intermediate and heavy duty.

RESISTORS — withstand heat, moisture, vibration and other adverse conditions.

RHEOSTATS—wide range of sizes, types and current ratings from ring types to industrial assemblies.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

ARMY E NAVY

Electric control (WL) *devices since 1892.*

WARD LEONARD ELECTRIC COMPANY · 47 SOUTH ST. · MOUNT VERNON, N. Y.

"All clear" is a welcome greeting

when returning from a sortie.

As one of our DFC boys puts it:

"*Going* on twenty-five missions is a tough job—

but it's getting *back* to the base that counts."

. . . Super-Pros are on the job every minute with the AACS.

THE SIGN OF QUALITY

ESTABLISHED 1910

THE HAMMARLUND MFG. CO., INC., 460 W. 34TH ST., N.Y.C.

MANUFACTURERS OF PRECISION COMMUNICATIONS EQUIPMENT

A C-47, called the workhorse of the Army Air Forces, flies over the radio-control tower at the 2nd Ferrying Group's base near Wilmington, Dela.

COMMUNICATIONS on the World's Greatest Airline

By LT. COL. HOWARD J. HAINES
Adj. Gen., Ferrying Div., ATC

The Ferrying Division of the Air Transport Command has led the way in securing the most modernized air-ground communications system.

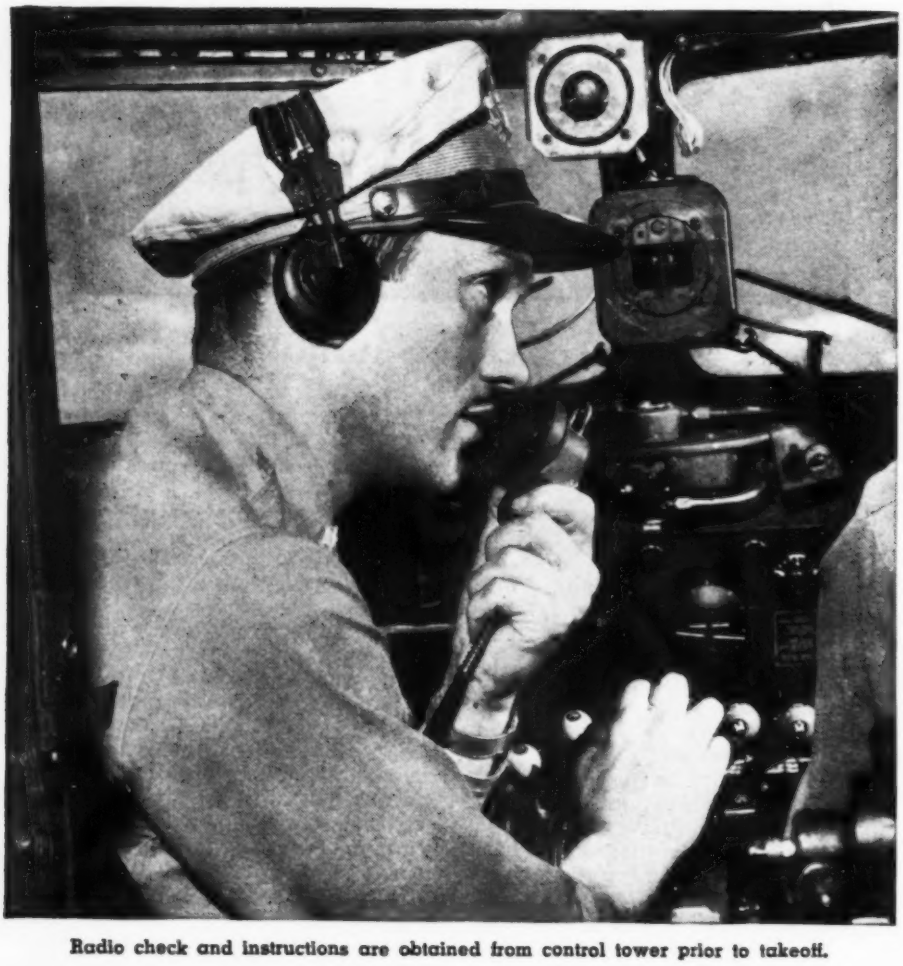
TAKE a C-47, converted for evacuation transport, put it in the air between New York and Nashville with a precious human cargo consisting of 10 litter patients and 8 ambulatory cases, all recently returned from battlefields of Europe and bound now for general hospitals near their homes, and you have a responsibility on your hands which demands constant air-ground communications between the pilot and radio stations along the route.

Remove the litters and the seats from the same plane, load it with vital engine parts which must be rushed from Newark to Miami, Florida where the "Fireball Express" will pick up the parts and carry them across Africa and Asia for delivery to the battle fronts, and you would not want your strictly nonexpendable crew, plane, and cargo to get lost on the way to Miami.

Put 21 seats back in the same plane, and fill them with highly trained pilots and navigators who have just ferried planes from Detroit to Long Beach, California and are now being returned to their home stations, and it would not be sound flying procedure to be out of touch with the plane for very long—the cargo would be much too valuable.

Do these three jobs every day of the week on 27 separate airlines, stretching up and down these United States for more than 86,000 miles, and in doing them fly 1,000,000 ton miles a month and evacuate more than 6,500 wounded fighters per month from coastal hospitals to hospitals near their homes, call the whole thing Military Air Transport, and you would be operating just about the world's greatest airline, and would need the world's finest air-ground radio communication system to make sure that your planes

Radio specialist checks ground station transmitter with a call to the tower.



Radio check and instructions are obtained from control tower prior to takeoff.

Brig. Gen. Bob E. Nowland, Comm. General of the Ferrying Division of the ATC.

would be able to fly around storms, avoid mountains, and arrive at their destinations with clock-like regularity.

Late in May, 1944, the Ferrying Division of the Air Transport Command was called upon by its parent organization to do those three jobs. It was directed by Air Transport Command Headquarters in Washington, D. C., to take over eighteen air routes formerly operated by private airlines in the United States.

The Ferrying Division, which is under the command of Brig. Gen. Bob E. Nowland, command pilot and veteran of 26 years with the Army Air Forces, was eminently equipped from almost every standpoint to do the jobs.

From its Headquarters in Cincinnati, Ohio, it could call upon nine Ferrying Groups for the planes and for the trained pilots and crews to operate them. Moreover, the fliers were superbly trained, for they had long been performing such missions of the Ferrying Division as ferrying planes from factories to the battle sectors, and had been flying foreign transport routes reaching across ocean and desert for thousands of miles, as far as India. There were mechanical crews handy to service the planes; almost every imaginable essential for successful operation of such a group of military air transport lines.

Only one thing was missing—adequate air-ground radio communications, facilities for talking from plane to ground comparable to those in use by the commercial airlines.

True, the Army Airways Communications System, which functions under the Air Communications Officer, who is a member of the Air Staff with Headquarters in Washington, had ap-

An invaluable aid to safe and efficient flying is this Bendix transmitter receiver. Specially-trained men are employed for the installation of this type of equipment.

Radio technician of the 2nd Ferrying Group tunes up a transmitter unit.

proximately 80 AACS stations set up throughout the country; but these stations were not equipped to provide the same service as the air-ground stations maintained by commercial airlines. Successful scheduled commercial operations hinge upon periodic voice communication from plane to ground and vice versa, keep the aircraft virtually in constant contact with the ground, and afford consequent flexibility of operation and a tremendous safety factor.

There was only one solution if the Army Air Forces was going to operate efficient military air transport lines within the United States. The Ferrying Division, designated to do so, would have to lead the way to securing modernized air-ground communications for the Army, comparable in every way to those used by the finest commercial airlines.

The writer, who has the title of Adjutant General for the Ferrying Division, but is also Director of Communications and Signal Officer and still likes to think of the days when he was radio "ham" W2EIS, drew the job of forming a sort of flying wedge, to use oldtime football parlance, which could smash through any potential lines of delay and secure modern air-ground communications in a hurry.

Carrying the football analogy a yard or two further, it had been possible, fortunately, to get the wedge force in shape with some "Spring training," during which fundamentals were implanted which would lead to a speedy drive to the goal of modern air-ground communications.

On March 9, 1944, a board from the office of the Air Communications Officer had visited Ferrying Division Headquarters. The board was endeavoring to determine the communications requirements of the entire Army Air Forces.

The members of the board were told that the Ferrying Division needed Army Airways Communications System air-ground stations which would maintain the same standard of efficiency as those operated by private airlines.

When, on May 25, the Ferrying Division actually assumed operation of the eighteen airlines, and called them Military Air Transport, M-A-T for short, the new air-ground stations were still nebulous and far from realization.

Soon, however, a conference was held in the office of Maj. Gen. Harold L. George, Commanding General of the Air Transport Command. It was attended by representatives of AACS, by a communications man from the Secretary of War's office, by representatives of the Air Communications Office, and by high-ranking officers of the Ferrying Division.

At the conference, the air-ground communication needs, already known for the most part because of the earlier visit by the board from the office of ACO, were discussed in greater detail.

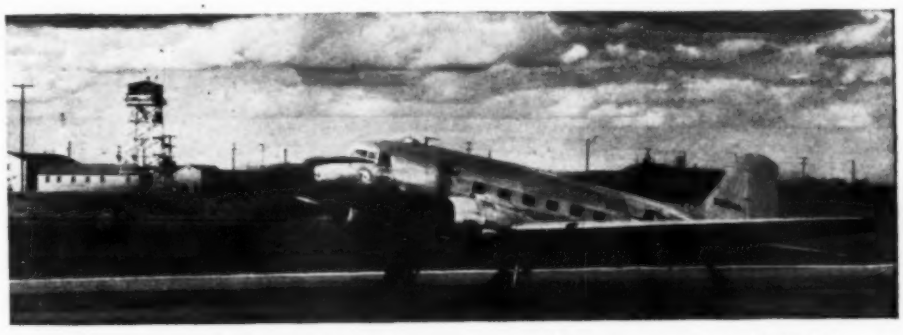
A short time later, a letter went forward from the Ferrying Division to Gen. George, for the attention of his Assistant Chief of Staff in the Communications Division of Operations, Lt. Col. W. D. Innes.

The letter set forth clearly the reasons why the Ferrying Division must have air-ground radio stations. Maps were attached showing the routes to be flown, and the number of aircraft to be flown on each route was indicated. It was suggested that as many such stations as possible be put into operation immediately. Request was made that each station be able to use two frequencies. In all, 47 stations were requested.

The result was instant cooperation on the part of the Air Transport Command, the Air Communications Office, and the Army Airways Communications System.

It was agreed that 47 modernized

(*Continued on page* 140)



In the first half of 1944 the Ferrying Division established a record of 40,000,000 ton miles over foreign routes. A C-47 is shown landing at one of its airfields.

DAD'S ADVICE

By RUSSELL J. PAIGE
Service Dealer

Dear Son:

I have just received your letter informing me that you plan to establish a radio shop in an Upstate New York city not very far from home. You tell me that you expect to use your mustering-out pay to set up shop and ask for some "down to earth" dope on the business side of radio servicing. I know that your experience before the war, plus your Signal Corps training, will give you all the background necessary as regards the technical end of the game. So I'll confine my remarks strictly to the "professional" side of the fence.

First of all, you'll be competing with old time radiomen who've been holding down the fort while you've been away. In addition, you'll probably encounter competition from a number of your "buddies" who haven't had your prewar training and consequently will not be as competent, though their claims may rival yours.

What should you do about such competition. Ignore it! The fellows who acquire their radio-servicing technique while serving with the Armed Forces are entitled to build up a profitable service business if they can. And the already-established serviceman has acquired a loyal group of customers who will quite justifiably stick with him.

Instead of worrying about your opposition—remember that the best defence is an offense. Place an advertisement in your local newspaper. Call it "My Platform". In this ad sum up briefly, but emphatically, all the experience you lay claim to. State your rates—your shop hours—and any services which other servicemen may not be rendering at present. Let a dignified presentation speak for itself.

Before publishing this ad do a little checking. If your competitors have a stranglehold on p.a. business—make your specialty auto radios. If their forte seems to be portables with emphasis on "servicing for a price"—o.k.—make your *piece de resistance* high-bracket combination radio-repairing. In your investigation check carefully with regard to the rural and suburban areas. Do they have adequate service representation or is there a field there that can profitably absorb your efforts.

In your investigation, however, disregard your competitors' price standards. If Johnny Jones, down the street, offers free service, and Blank, up the road a piece, favors "flat-rate servicing"—all well and good. And if "Cutrate, Inc." floods the community with 75¢ an hour labor charges—in

TO G.I. JOE

An oldtimer presents important facts, which apply equally as well to other men of our Armed Forces who intend to open their own service shops postwar.

the long run that will be their ruin and very probably their customers' personal headache. From my years in the field and frequent bull-sessions with my compatriots, it seems that $1.50 an hour for house repair, and $1.35 for shop-handling, appears an adequate and satisfactory standard of pricing. Whatever figures you arrive at—stick to your guns and let the customers fall where they may.

In your direct-mail, radio, window-izing—whatever form of advertising you decide to employ, sell your customers on one double-barreled theme. First of all they'll have to make their old sets do for many months, or if they purchase new sets they will be of prewar quality until production becomes settled. That being the case, they'll want a serviceman who is familiar with prewar models.

You ask me for advice about locating your service emporium. At the war's end, with "A" coupons a relic of the dim dark past, any locale will be a desirable one. Naturally it's nice to find yourself on or near Main Street. But, aided and abetted by the power of the press and the etherwaves—you won't lack for a clientele if your service work is of the top-notch variety.

It's important to have plenty of window space and to provide yourself with ample room for a service-chamber plus an ample reception room. In my talks with fellow servicemen we've come to many conclusions regarding the ideal service-shop.

Right off the bat there's this question of drive-ins. The dry cleaning industry has profited greatly by such establishments where patrons honk the horn and presto chango—service with a smile. Several of the shops in Northern New York intend establishing drive-ins. Customers put their ailing house radio in the back of the family jalopy and tote it to the drive-in where an attendant carries it into the service chamber—giving the customer a receipt. These servicemen plan to discontinue all house calls after V-day with the exception of aerial installations. If these plans go through, customers can leave a set for service at the drive-in anytime during the morning and pick it up late that afternoon.

Service folk who plan only to remodernize their shops have some mighty interesting ideas up their sleeves as well. For example, C. E. Alberts, of Syracuse, plans to have a service-test lab with a glass partition separating it from the outer reception room. This "lab" will have not one but three separate work benches—each equipped with panel-meters, oscillograph, oscillator, and all test equipment. Facilities for three servicemen working side by side will be maintained. In the center of the "lab," equidistant from all three service benches, will be the "reference rack" containing manuals — loose schematics—customers' individual records — manufacturers' dope-sheets, etc. A "tube" compartment with space for over 1000 tubes will be at one end of the lab.

Each service bench will have "bins" for condensers, resisters, transformers, and parts used frequently in set repair. Work-seats on rollers will be part and parcel of each bench so that the serviceman can move from one end of the bench to the other.

To the right of the "lab" will be the receiver room where sets needing service are placed. To the left of the "lab" will be the "customer's test room." Here sets repaired may be tried out by patrons before they leave the shop. As many as 6 sets may be tested simultaneously—antennas of the noise-reduction variety and filters will keep strong electrical noises at a minimum.

Now for the reception room itself. There will be easy chairs—a periodical rack with late issues of popular magazines available, the receptionist's desk, etc. Customers may look through the partition and observe servicemen busy at their work. But because the lab is soundproof, no remarks from the paying patrons will filter through. The customer is handed a card by the receptionist on which goes name, address, make of receiver, and symptoms. Instead of telling it to the serviceman the customer writes it out briefly. If a certain price-level is not to be exceeded, that information is duly chronicled on the card as well. Customer's phone number completes the data. The ticket is in triplicate—customer retaining the original—one copy attached to the set, and the third kept by the receptionist.

This serviceman is willing to deliver the repaired set or the customer may call and listen to the set perk, right on the premises before paying for same. When the set is ready for return—the receptionist phones the patron and he or she can decide which course to follow.

Under this arrangement the serviceman can concentrate on his legitimate functions (i.e. repair) while the receptionist handles routine customer transactions. Directly off the outer reception room is a small office where the serviceman may hold bull sessions with industrial clients—those desiring electronic or special services. This "office" boasts an executive-type desk and several chairs for the customers whose business brings them into the "inner sanctum."

One of my competitors is planning to erect a "traveling servicenter" for postwar usage. It will be a trailer equipped with service bench, tube-testers, and all accompanying paraphernalia, as well as a generous supply of tubes and spare parts galore. This "repair shop on wheels" will tour the farm areas—servicing farm radios, electric fences, etc. In addition, this radioman intends to hit the small communities with less than 500 population. I can't predict the success this chap will have with his adventure but I'll be watching with interest.

It's getting time to close but I can't overlook mentioning my radio-repairing crony whose postwar service-shop, while modeled somewhat on the lines of the one I described above, will, in addition, boast a full-fledged television chamber. This man intends to set aside three hours nightly for study and experimentation with television circuits. He intends to secure one of the first postwar television units and study it at first hand even if he can't pick up a visual signal for a spell. Off hand, I think he's got something there—television may be around the corner—it may take several years to spread into the small communities like ours, but the serviceman who has kept abreast of this field will be "in the money" when it finally does touch home port.

Best regards as ever, and slap a Jap for me.

Dad

PHASING OF LOUD SPEAKERS

By NICHOLAS B. COOK

Failure to observe proper phasing of speakers will result in an inefficient audio installation with apparent deadspots and lower volume.

A FACT well known to sound men is that in order to obtain best reproduction of sound with more than one speaker, it is necessary that the speaker cones move "in phase." They must all move in or out, "in step," so that the total cone area may be regarded, in effect, as a single diaphragm. In this manner, each speaker contributes aid and reinforcement to the sound wave. If the speakers are not in phase, there will be interference and cancellation.

Not so well known, however, are the means for checking the phase relations, particularly where line-matching transformers are involved. One method permits testing by ear while the speakers are connected; other methods make use of polarity relations, both mechanical and electrical, by which proper phasing is assured at all times.

Ear Test

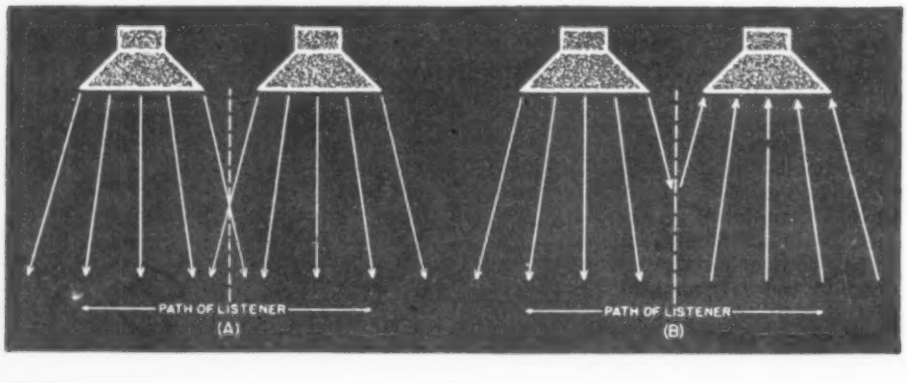
In order to make the ear test, the following procedure should be followed: Place two speakers in a horizontal line, typical of their placement in a theater. Next, turn up the gain to produce hum and walk across the stage in front of the two baffles, from the outer edge of one to the outer edge of the other.

If the hum level is approximately uniform, the speakers are in phase. However, if the hum is appreciably lower in the vertical plane between the two baffles than at the outer edges, the speakers are out of phase.

A second test is to place two speakers in a vertical line. The procedure is similar to the above, except that the listener must move in a vertical plane. In this case, if the speakers are out of phase, the hum level will be appreciably lower in a horizontal plane between the two speakers.

In the final analysis, instead of remembering these rules, it is helpful to draw a simple diagram representing two speakers in phase and out of phase (Fig. 1). Fig. 1A shows that the instantaneous wave is outward from both cones. Clearly, there is reinforcement where the outputs overlap. In this plane the level is not likely to be *lower,* but rather somewhat *higher* than at the ends of the path transversed by the listener. In Fig. 1B it is shown that the instantaneous wave is *outward* from one cone and *inward* toward the other. Cancellation occurs where these two effects overlap. In this plane the hum level will be appreciably lower.

Fig. 1. Proper phasing can be determined by applying ear test. When out of phase the hum level will be lower, in a plane between the two speakers, than at the outer edges (B). When correctly phased, a more uniform distribution of volume will be obtained (A).



Phasing Voice Coils

When phasing voice coils, the first step is to excite the speaker field, and then short out the hum-bucking coil, if one is used. Next, apply 1.5 volts from a flashlight cell to the voice-coil terminals. By the trial and error method, polarize the voltage so that the cone jumps *outward* on voltage contact, and put an identifying mark on the voice-coil lead to which the positive voltage was applied when the cone jumped outward. Speakers having permanent magnet fields require no further check.

When the field is electrically excited, the positive terminal of the field coil (as then connected) must be determined and marked. In both cases, the polarity now has been definitely established.

As an aid to remembering that the cone jumps outward, we may recall the rule that *like* poles *repel.* (*Positive* voltage goes to *positive* terminal; cone is *repelled.*) It is generally understood that voice coil currents are assumed to *enter* at the positive terminal. For the use of parallel operation, like terminals are connected together, while for series connection, the unmarked terminal of the first speaker must be joined to the marked terminal of the second, and so on.

Transformer Connections

In a case where a line-matching transformer is used, the phasing between the line and voice coil may be

done in a similar manner. By reason of the step-down ratio of the transformer, a higher voltage is required. A 22½-volt "C" battery may be applied to the line. When the cone jumps *outward*, the positive terminal of the transformer (high side) should be marked.

The polarity of the voice coil is still unknown. For this reason it is best to proceed as follows:

1. Determine the positive terminal of the voice coil in the manner previously described.
2. Connect the transformer to the voice coil. Determine the positive terminal of the primary (the line side). Also, mark the secondary lead that goes to the marked terminal of the voice coil.

Now both the speaker and the transformer are polarized *permanently*. When such marked units are interchanged with others, properly connected, and similarly marked, the speakers will always be in phase.

Transformer Polarity

Transformer polarity is a matter of great importance to the power engineer. The radioman becomes acquainted with it when he replaces an r.f. primary or some other transformer winding in a tuned circuit. He has learned also that feedback may be good or bad, depending upon the polarity of certain coils.

In the electric power industry the practice of marking transformer terminals in such a manner as to indicate the *sense* of the winding has been standardized by the American Institute of Electrical Engineers. The sound man will derive considerable profit from these conventions.

Fig. 2A shows that the assumed instantaneous direction of current flow is into terminal H_1 and out of terminal X_1 as indicated by the arrows. So far as phase relations are concerned, connecting to terminal X_1 is equivalent to connecting to terminal H_1 (Fig. 2B). The magnitude of the secondary voltage (with given primary voltage) depends upon the turns ratio. Phase change is zero in the ideal transformer.

A standard method of checking polarity is by means of voltage measurements, as shown in Fig. 2C. The correct procedure is to connect a jumper between H_1 and X_1. Apply voltage to the primary (high) side, and measure the voltage between points 1-2 and points 2-3. If $E_{2\text{-}3}$ is *less* than $E_{1\text{-}2}$, the polarity markings are correct.

The sound man may adopt the following method to determine the polarity of audio transformers.

1. Select one terminal of either the high or the low side and mark it +.
2. Tie this terminal to one lead of the other winding.
3. Apply voltage to the high side and measure voltage (1) across high side and (2) between terminals not tied together.
4. If measurement (2) is lower than measurement (1), then the terminals tied together are of the same polarity.
5. If measurement (2) is higher than measurement (1), then the terminals tied together are of opposite polarity.

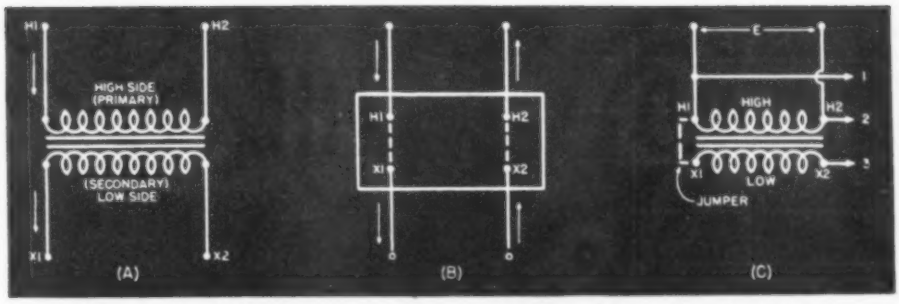


Fig. 2. (A and B) Assumed instantaneous direction of current flow in an output transformer. (C) Determining proper polarity, applying voltmeter method.

Fig. 3A is a diagram of connections and an actual test of a "line to voice coil" transformer. In order to determine the polarity, one terminal of the primary has been arbitrarily selected as positive. The voltage measurements are $E_{1\text{-}2}$ measures 6.6 volts and $E_{2\text{-}3}$ measures approximately 6.0 volts. Therefore, it is determined that terminal *a* is the positive terminal of the secondary.

Tapped or extended windings can be checked similarly. The polarity of each section is the same as the polarity of the entire winding, as shown in Fig. 3B. Terminal 1 is positive to all other secondary taps, terminal 2 is positive to 3 and 4, and so on.

Checking with D.C.

To check transformers by using direct current, connect a d.c. voltmeter across the low side of the transformer. The range may be 50 v. for the first trial. Next, designate and mark one primary lead as positive and connect the other primary lead to the negative side of a flashlight cell. Now touch the marked primary lead to the positive pole of the cell. The voltmeter pointer should deflect momentarily up or down scale. If it does not, then reduce the range. When the pointer jumps *up* scale on contact, then the secondary lead connected to the positive terminal of the voltmeter is the positive end of the secondary. With this connection, the pointer should jump *down* scale when the contact is broken. Keep the voltmeter range high enough so that deflection will be small and make sure that a deflection up scale is not just a rebound from a jump down scale.

This d.c. test is not recommended for transformers of the better grade, since it may put a magnetic bias on the core. However, a series condenser may be used to block the steady direct current while allowing a polarizing pulse to flow. The various connections are shown in Fig. 3C, although the values given are for a particular case.

In the case illustrated in Fig. 3C a milliammeter can be used. Here,

(*Continued on page* 126)

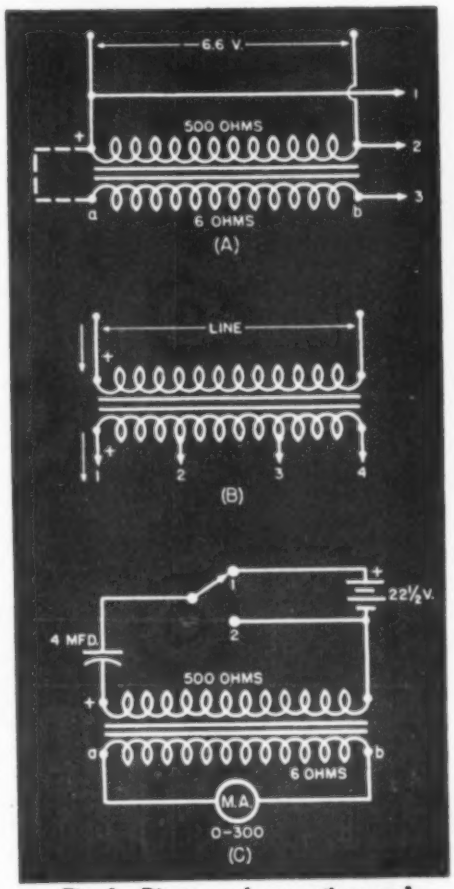
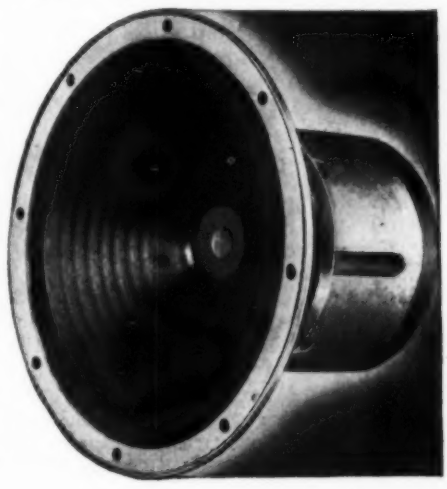


Fig. 3. Diagram of connections and polarity test of an output transformer.

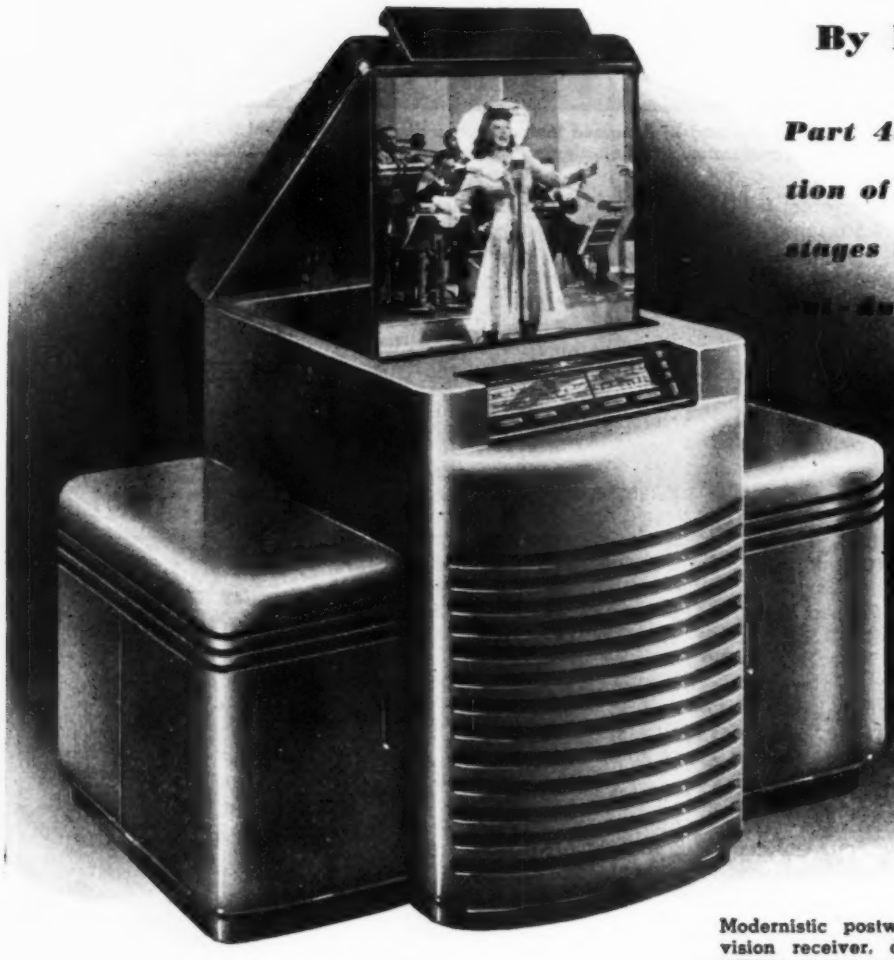
P. M. speaker presents less phasing problems in view of absence of field coil.



THE Television

By EDWARD M. NOLL

Part 4. The fundamental operation of various r.f., i.f., and video stages that are employed in present-day television receivers.



Modernistic postwar combination AM, FM, and television receiver, designed and illustrated by RADIO NEWS' staff artist. The two side pieces are separate units and may house records and automatic changer.

WHAT are the five major functions of the television receiver?

1. Demodulates the picture carrier.
2. Applies picture signal to the control grid of the picture tube.
3. Applies blanking to the control grid of the picture tube.
4. Applies horizontal and vertical sync pulses to the picture-tube sweep circuits.
5. Demodulates the sound carrier.

How does the television receiver differ from the conventional broadcast receiver?

1. The television receiver is a high-frequency receiver. Our present broadcast band could only contain 1/6 of one single television channel. Thus, it is necessary to use a high-frequency where a six-megacycle bandwidth is only a small percentage of the carrier frequency.

2. Antenna and i.f. stages must have a six-megacycle flat band-pass characteristic; picture i.f. stages, at least two to four megacycles. The broad flat band-pass is necessary to produce a picture of clarity and definition.

3. The video response of the video amplifiers (comparable to audio amplifiers in a broadcast set) should have at least, a two to four megacycle band-pass for the same reason.

4. Special pulse and sweep circuits are necessary to move and synchronize the scanning beam of the picture tube.

5. Sound and picture carriers are picked-up on the same antenna and passed through the same r.f. section to the mixer. Sound and picture, then, divide into separate i.f. channels.

R.F. Section

The television antenna is a tuned (resonant) antenna on the frequency of the channel to be received. This antenna, though tuned, is not sharply resonant, to prevent degeneration (loss of definition and clarity) of the high-frequency sideband components of the picture signal. In some instances, a more elaborate antenna is used which is broadly resonant over two or three adjacent channels, permitting the reception of a number of stations with the same antenna. Types of antennas which are reasonably flat and conveniently match low-loss transmission lines are dipoles with large periphery elements, folded dipoles, V antennas, or conical antennas. For a more complete discussion on antenna types watch for the May installment.

Mount the antenna high and free, and use superior quality transmission line, for if the transmission line has high shunt capacity and leakage, the gain obtained by increasing antenna height is off-set by the additional loss in the cable. A carefully matched and tuned antenna system is a requisite for obtaining good signal strength and low noise pickup. The transmission line terminates in the tuned input circuit of the receiver; from whence, it is generally coupled directly to the mixer. (See Fig. 3.) Prewar receivers

RECEIVER

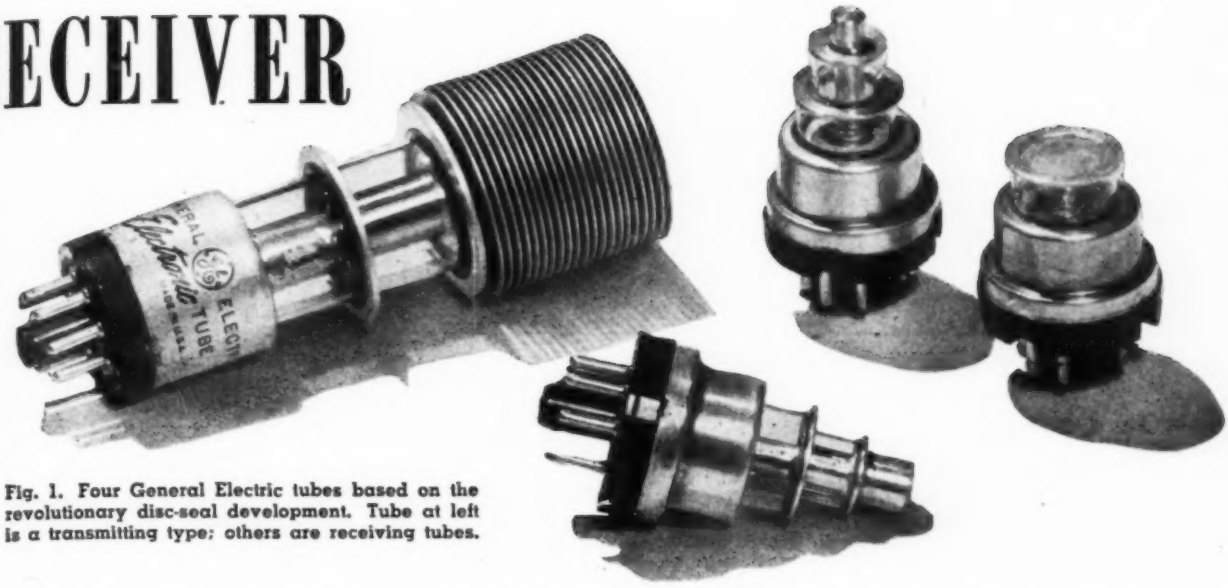


Fig. 1. Four General Electric tubes based on the revolutionary disc-seal development. Tube at left is a transmitting type; others are receiving tubes.

only occasionally used an r.f. amplifier because the high interelectrode capacities of the tubes and the broad-band characteristics of the circuit, required constants which did not improve receiver performance enough to warrant the additional cost. However, with special high-frequency tubes such as shown in Fig. 1 having high gain and low input and output capacities, the r.f. amplifier of the postwar receiver will be both useful and practical.

Since the antenna signal is applied directly to the mixer, as shown in the block diagram Fig. 3, it is necessary to obtain the utmost gain from this stage. To produce a higher conversion gain (how effective the mixer is in converting the r.f. voltage to an amplified i.f. voltage) a separate triode is used as a local oscillator. The oscillator is generally a modified Hartley, Colpitts, or ultra-audion high-frequency oscillator, generally operating on a frequency 12¾ megacycles above the picture carrier and 8¼ megacycles above the sound carrier. Local-oscillator frequencies for the first three channels are respectively 64, 74, and 80 megacycles.

(Ed.: These frequencies will be changed to 44-50, 54-60, and 60-66 mcs. if the proposed FCC frequency allocations are accepted in their present form.)

The plate circuit of the mixer, therefore, contains two different frequencies; one of 8¼ megacycles and the other 12¾ megacycles. Now, if two resonant circuits are used, one responding to one frequency and the second to the other frequency, and, at the same time, each tuned circuit completely rejects the frequency to which it is not tuned, a means of separating sound and picture is evolved.

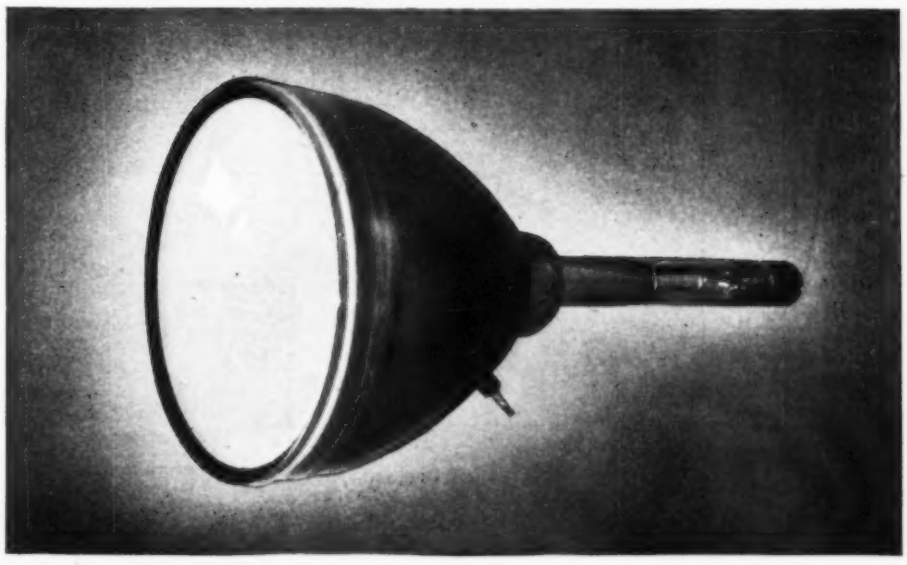
I.F. Systems

Therefore, by using a single oscillator and two separately tuned i.f. systems tuned to frequencies that differ by the frequency separation of the sound and picture r.f. carriers, the picture and sound pass into separate i.f. amplifiers. The sound signal continues through the limiter stages to the FM discriminator, where it is detected, and, thence, to the audio amplifier and loudspeaker. The picture i.f. system must have a wide flat bandpass, and, for that reason, the i.f. transformers are loaded by shunt resistors which lower the circuit Q and increase the bandwidth. This, in turn, reduces the gain per stage, increasing the number of required stages to produce a given amplification. Other characteristics of the picture i.f. system are the occasional overcoupled transformer to increase bandwidth, use of high mutual conductance tubes with low interelectrode capacities, and i.f. transformers having the proper inductance to resonate with the total distributed capacity at the i.f. frequency. These i.f. transformers, which are tuned by movable iron cores, are very seldom shunted by any physical capacitor and, consequently, have a high L C ratio, ascertaining a reasonable stage gain with a broad bandpass. Cathode resistors are often left unby-passed to prevent too great a variation in input capacity with changes in grid potential.

Detector and Video Amplifiers

The amplified picture i.f. signal is now applied to a diode detector which is conventional except for the low-value diode load resistor. Although the low value resistor reduces the efficiency of the diode it is necessary to minimize the effects of the shunt circuit capacity on the high frequencies. All through the television receiver, in fact all through the television system, we are continually protecting the signal from shunt capacity which attempts to carry our high-frequency

New type flat-face picture tube, developed by the Philco Corp. In final assembly magnetic coils are placed around the neck of the tube. Fig. 2 shows proper placement of these coils, along with the operating details of this tube.



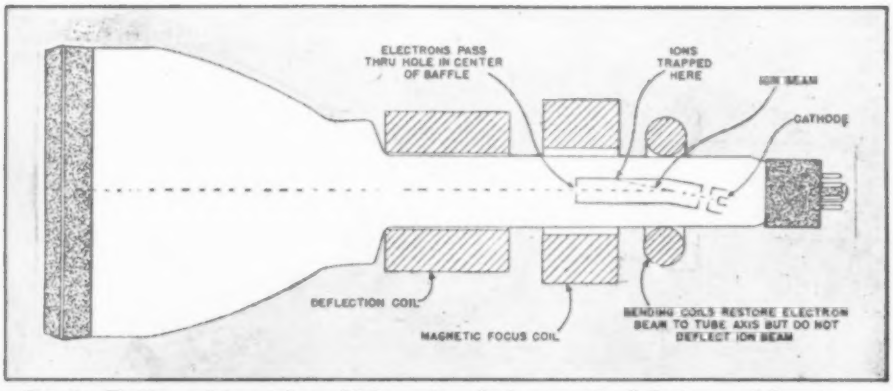

ELECTRONS PASS THRU HOLE IN CENTER OF BAFFLE
IONS TRAPPED HERE
ION BEAM
CATHODE
DEFLECTION COIL
MAGNETIC FOCUS COIL
BENDING COILS RESTORE ELECTRON BEAM TO TUBE AXIS BUT DO NOT DEFLECT ION BEAM

Fig. 2. Flat-face picture tube, which employs both magnetic deflection and focusing.

components to a ground potential.

The output of the detector circuit separates again into two channels: sync pulses are clipped off the top of the composite signal and applied to the sweep circuits; while picture, blanking, and sync are applied to the receiver video amplifiers. Similar precautions are taken in the receiver video amplifiers as in the transmitter video amplifiers to maintain a linear response and a reasonable gain. Here, too, a fixed black level must be established by a so-called d.c. restorer circuit to produce a picture with the proper light range. The output of the video amplifier is impressed on the control grid of the picture tube as a negatively polarized signal; that is, the greater the signal amplitude the more negative the grid is driven, the weaker the picture-tube electron beam becomes, and the darker the spot on the screen becomes upon which the beam is directed. The brightness control of the picture-tube control circuit sets the grid bias on the picture tube at a value which will cause the fluorescent screen of the picture tube to blank out when the signal reaches it blanking level; therefore, during the blanking and sync pulse intervals the electron beam is cutoff and the screen does not fluoresce. Between blanking intervals the screen is illuminated in accordance with the instantaneous potentials of the video signal which is usually at some value below the blanking voltage level.

Sweep Circuits

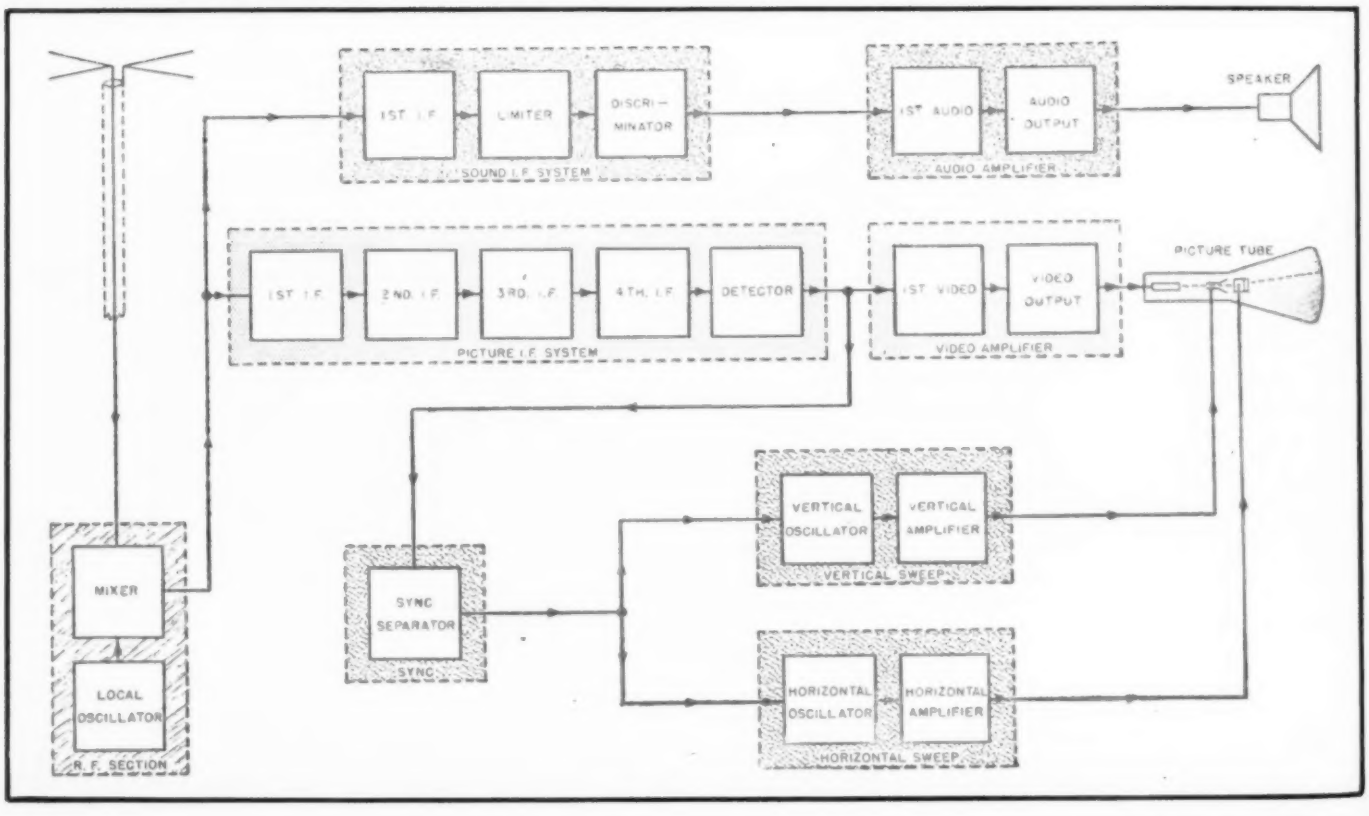
Sync pulses are removed from the picture signal by a sync separator which clips off the top 25% of the composite television signal, applying these pulses to the horizontal and vertical deflection circuits to synchronize the motion of the picture-tube beam with that of the pickup tube beam. The input circuits of the sweep circuits are designed to respond to one type of sync pulse and not the other. Thus, the faster horizontal pulses only synchronize the horizontal oscillator, and not the vertical oscillator which is synchronized by the lower frequency and longer duration vertical pulses. Each deflection circuit consists of a sawtooth generator which generates the sawtooth sweep and an amplifier to increase the amplitude of the sawtooth voltage to the proper level for deflecting the beam over the full length or width of the fluorescent screen. The sawtooth generators are free running; that is, the actual beam is deflected on the scope whether signal is applied or not. However, when signal is applied and sync pulses reach the sweep oscillators, the oscillators are locked-in at the correct frequency (15,750 per second for the horizontal and 60 for the vertical), putting the scanning beam in step and holding the picture stationary.

Power Circuits

The receiver uses two power supplies, one high-voltage supply for the electrodes of the picture tube and a second low-voltage supply for the other tubes in the circuit. The low-voltage supply is conventional and uses an inductor-capacitor filter. Since the current drawn by the high-voltage picture tube circuit is so very small a resistor-capacitor network adequately filters the high voltage. The high-voltage supply uses a half-wave rectifier; low-voltage supply, a full-wave rectifier.

(*Continued on page* 152)

Fig. 3. Block diagram of television receiver. High-frequency tubes combining high gain and low input and output capacities must be used.



Portable recorder and amplifier-equalizer unit in operation.

A New Portable Disc Recorder

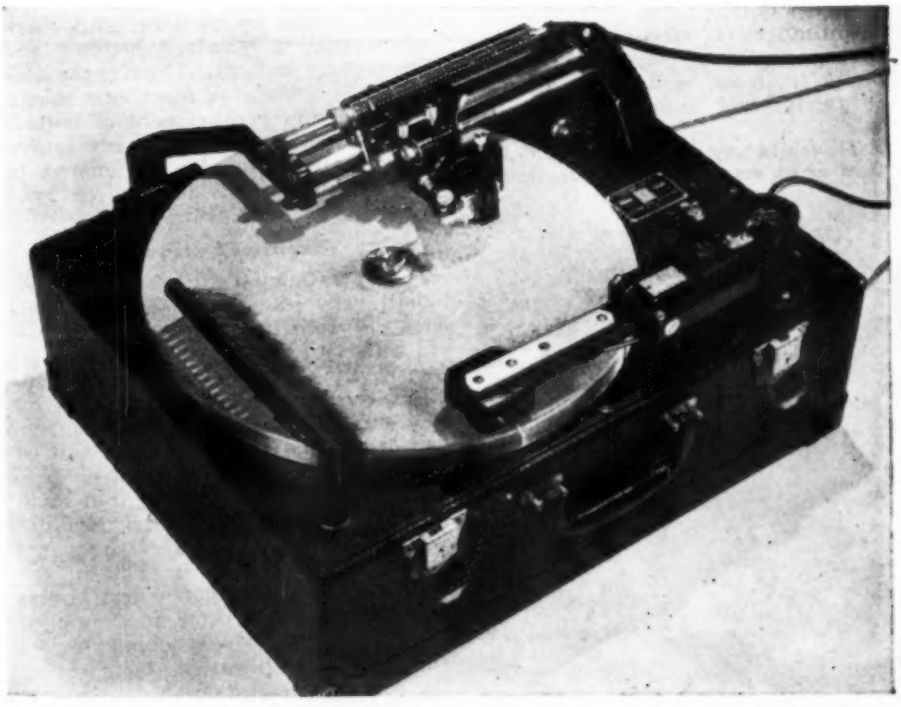
This portable 16-inch recorder, operating at 33-1/3 or 78 r.p.m., meets the requirements of direct-lateral recording reproduction.

By P. PETERS
Fairchild Camera & Instr. Corp.

THE field of instantaneous sound recording is a fast growing industry which is opening a wide variety of job opportunities. This quick method of recording sound for direct playback has caught the attention of educational institutions all over the United States. Since it was introduced into colleges a decade ago, the practice of recording has grown steadily until it is now standard in nearly all college speech departments.

Excellent training for engineering students in radio and recording techniques is provided as they get actual experience in recording broadcasts. Future script writers and those training in radio production who receive this training should be able to get jobs in the field of radio without much difficulty. Employment is also open for teachers acquainted with the sound recording methods of instruction and the equipment they use will require servicing; hence another ave-

(*Continued on page* 142)



This professional recorder and playback unit is equipped with a dynamic pickup.

EMERGENCY Radio Receiver Tests

By Capt.
STUART D. DISTELHORST

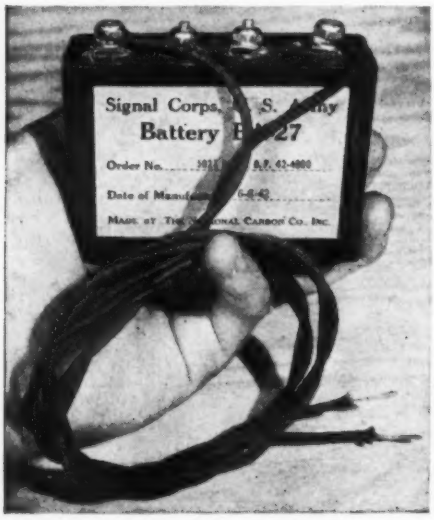
An ohmmeter, neon bulb, and high d.c. voltage source or a small battery and headset, are all that is needed to complete these tests.

Many servicemen will find these simple tests highly effective in repairing home receivers.

THE scarcity of adequate radio receiver test equipment, due to the increased wartime need for huge quantities of accurate instruments, has placed increased emphasis on expedients for both military and civilian radio repair work. None of these methods are new; they have been used by professional and amateur radio men for some time. Since it may be some time before test equipment will again be available in anywhere near the quantity that most radio men might desire, a few of the most helpful steps in servicing radio receivers without normal test instruments are detailed here.

Continuity of circuit wiring, resistors and capacitors, tubes, high-voltage systems, and audio outputs are fairly well tested with readily available components and a certain amount of signal tracing can be accomplished. While a flashlight bulb and battery, or buzzer and battery, or even a standard light bulb and 110-volt commercial supply might be used for some of the tests, this low-sensitivity equipment would be adequate only for low-resistance components such as cords, small coils, and filament circuits. The high resistances encountered in radio circuits require high-sensitivity tests. Thus, a standard ohmmeter, multitester, or other type of analyzer is desirable. However, a neon bulb and about 90 volts of d.c. might be used or, still more practicable, a standard headset and low-voltage battery. Usually the 4½-volt "C" battery is most convenient, although any arrangement of batteries that will provide a steady source of current at a voltage low enough to prevent accidental damage to tube filaments is satisfactory.

A 4½-volt battery and test prods may be used as an emergency signal generator.



Circuit Continuity

For testing high resistances or small capacitances it may be necessary to resort to higher voltages—45 volts or 90 volts—to get additional sensitivity. Before making continuity tests, make certain power is off—disconnect power cord or remove batteries—and take the tubes out of their sockets to prevent any damage to them. Then, with test prods connected across battery and headset, continuity between any two points will be indicated as a click in the headset. This emergency test equipment can be checked for maximum indication, just as an ohmmeter is checked for calibration, by shorting the ends of the test prods.

With a little experience the difference between a high resistance and a low resistance can be estimated with considerable accuracy from the loudness of the click heard in the headset. Lacking standard equipment, any available insulated wires may be used for test prods. If lightcord or other standard twisted-pair is used, a drop of solder on the ends will keep the strands from fraying and provide a satisfactorily firm test-prod tip. Open coils, faulty transformer windings, and broken pigtails can be quickly located in this way.

Testing Capacitors

The same equipment can be used for testing capacitors for leaks, shorts, and open circuits. If the capacitor is part of a circuit, make sure the capacitor is not shunted by other circuit elements. The influence of load resistors across a.v.c. capacitors and bleeders across filter capacitors can be eliminated by disconnecting one lead of the resistor normally connected to the capacitor under test. If the capacitor is all right, a click is heard in the headset as the voltage is initially applied. In the case of a large capacitor such as is used in filter circuits, the click may be heard the first few times prods are applied across the capacitor until it becomes fully charged. After several applications any discernible click will disappear. If the capacitor has a leak or is shorted out, the click will be heard with equal intensity each time the voltage is applied. If the capacitor is open, of course, no click will be heard when the test prods—and the voltage—are applied.

When testing small capacitors in this way, it may be necessary to use higher voltages than the 4½-volt "C" battery to secure an indication that

Capacitors being tested must not be shunted by other elements. One side should be unsoldered if there is any doubt.

If a test capacitor charges itself when placed across the "B" plus circuit, it will indicate that high voltage is present.

the capacitor is not open. Don't attempt to apply 150 volts across a 25-volt paper capacitor as it may become permanently damaged. There is little chance of this, however, because most low-voltage capacitors have sufficient capacitance to provide an indication using only 4½ volts if the capacitor is undamaged and serviceable.

Testing Tubes

The best test of a tube is its operation. Even the most expensive testing equipment does not tell the whole story. In an emergency and without any test equipment, the tube may be placed in its socket and the power turned on to provide normal operating conditions. First look for filament glow or feel for warmth as an indication of filament or heater continuity. Rectifiers and power amplifiers get fairly hot so feel all tubes gingerly until sure you will not be burned. The tube may then be tapped with a finger while listening to discover any loose elements or intermittent shorts or open circuits. These will ordinarily be indicated as a disturbance in the loudspeaker of the radio receiver.

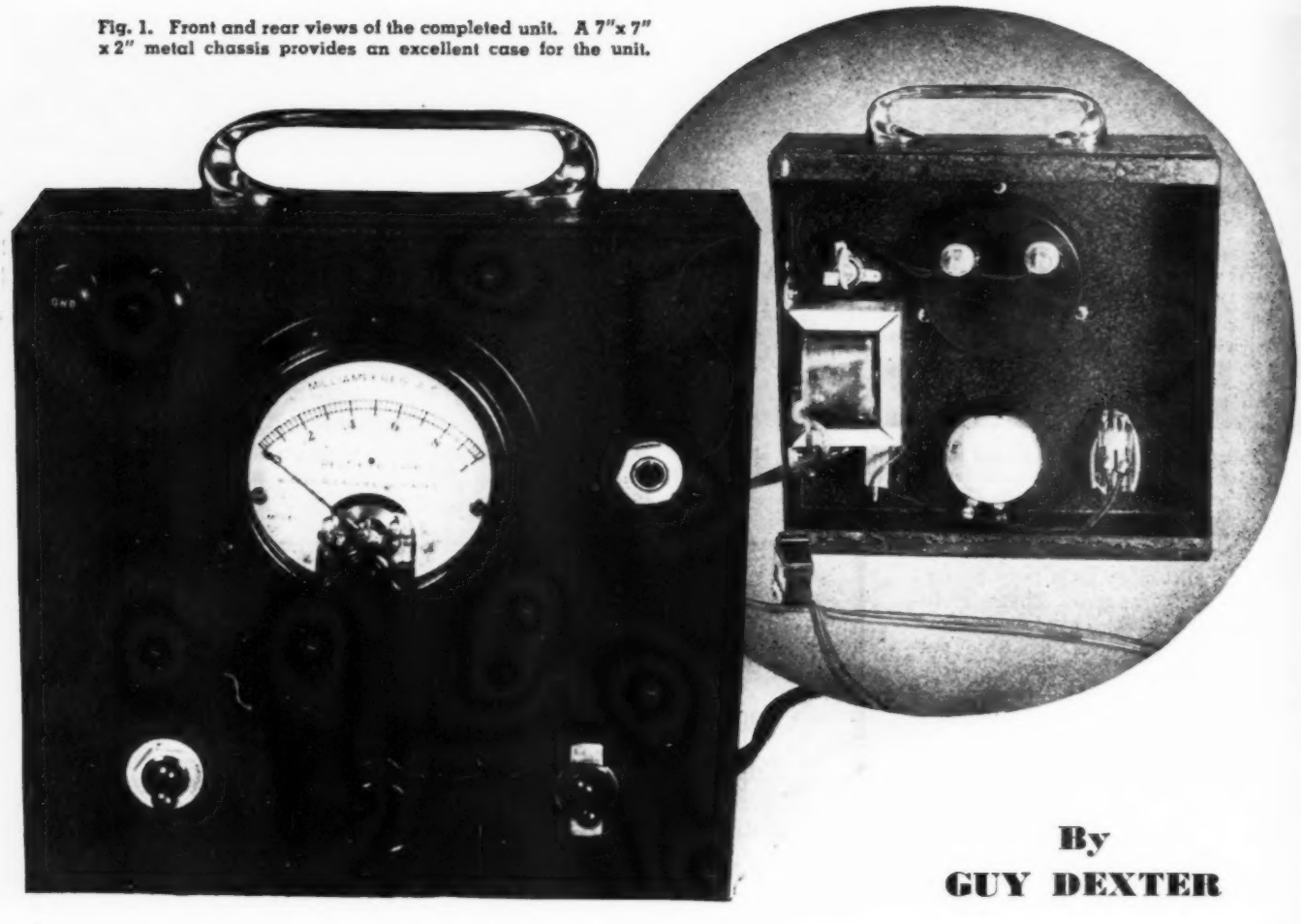
(*Continued on page* 138)

TESTS THAT CAN BE MADE

1. *Headset and battery serve as continuity check.*
2. *Headset and capacitor serve as emergency output meter.*
3. *Capacitor serves as an emergency d.c. voltmeter.*
4. *Battery serves as an emergency signal generator.*

Serviceman making continuity check by simply employing a headset, 4½-volt battery, and improvised test prods.

Fig. 1. Front and rear views of the completed unit. A 7"x 7" x 2" metal chassis provides an excellent case for the unit.



By
GUY DEXTER

DIRECT-READING IMPEDANCE METER

AUDIO-FREQUENCY impedance measurements are not outside of the realm of radio servicing. Speaker voice coils, transformer windings, wirewound resistors, and iron-core choke coils, all occasionally need to be checked for impedance. But in spite of its usefulness, impedance measurement has never ceased to be a bugaboo to the serviceman. This is due chiefly to the lack of inexpensive, easily-operated impedance meters.

Sometime ago, we published building instructions for a small bridge-type impedance meter.[1] Since that time, we have received a number of requests for a still simpler meter—most of all, one which requires no bridge adjustment or similar manipulation in order to read impedance. We attacked the problem from various angles and invariably came up with a gadget too complicated for workaday service applications.

The simple, direct-reading impedance meter described in this article was selected after trying out numerous other designs. We believe it is the ultimate in simplicity. It is as easy to operate as a common d.c. ohmmeter and is used in the same manner. Impedance indications are made directly in ohms by a movable-coil milliammeter, no calculations need be made, and the instrument requires no adjustment except the ordinary *zero-setting* which is well known to users of ohmmeters. Two meter scales are provided: 0-100 and 0-10,000 ohms.

Circuit

Arrangement of the simple impedance meter circuit is illustrated by sketches A and B in Fig. 3. In Fig. 3A, a 0-1 rectifier-type a.c. milliammeter is connected in series with an adjustable low-voltage a.c. source and the "unknown" terminals X-X. The a.c. voltage is supplied at any frequency at which it is desired to measure impedance. Prior to making impedance measurements, the milliammeter is set to zero (right-hand extremity of the meter scale) by connecting terminals X-X temporarily together and adjusting the voltage. The jumper then may be removed and the unknown impedance connected to terminals X-X. The meter deflection will be proportional to the unknown impedance, and the meter scale accordingly may be graduated in impedance units (ohms). The series circuit of Fig. 3A is satisfactory for high values; that is, from a little under 100 to several thousand ohms impedance. The zero point will be the full-scale position of the meter.

In Fig. 3B, the 0-1 rectifier-type a.c. milliammeter is connected in series with the adjustable low-voltage a.c. source, as in the previous case. But in this instance, the "unknown" terminals are in parallel with the meter. The a.c. voltage may have any fre-

[1] *A Compact Direct-Reading Z-Meter, Turner.* RADIO NEWS, Oct., 1942, p. 10.

quency at which impedance is to be measured. Prior to making measurements, the milliammeter is set initially (to full-scale) by adjusting the a.c. voltage *without short-circuiting terminals X-X.* The unknown impedance then may be connected to the X-X terminals, whereupon the meter deflection will be proportional to the impedance value. The meter scale accordingly may be graduated in ohms impedance. The shunt circuit of Fig. 3B is satisfactory for low values; that is, from a few tenths to about 100 ohms impedance. The *zero-ohms* point will be the left-hand extreme of the meter scale (meter zero).

From these illustrations, it is seen that the direct-reading impedance meter is essentially an a.c. ohmmeter of conventional design. The shunt circuit provides a low-impedance range, and the series circuit a high-impedance range. Use of the instrument is reduced simply to setting the meter to "zero," connecting the unknown impedance to the terminals provided for that purpose (either by direct connection to the terminal posts, or by test prods), and reading the impedance value directly on the meter scale.

The a.c. voltage source may be an audio oscillator operated at the desired measurement frequency, or (for measurements at the power-line frequency) the low-voltage secondary of a transformer operated from the power line through a potentiometer.

Constructional details for a simple and inexpensive meter-type impedance checker for use in either home or shop.

The circuit schematic of the complete impedance meter is given in Fig. 2. External and internal views of the instrument are shown by Fig. 1.

Series and shunt circuits both have been made available in the final circuit, to afford high and low impedance ranges. The meter scales are 0-100 and 0-10,000 ohms. The double-pole, double-throw changeover switch enables the circuit to be switched at will from series to shunt, while keeping the same X-X terminals. When the switch is in the *high* position, the impedance meter circuit is arranged in the manner of Fig. 3A. When the switch is in the *low* position, the circuit is arranged as in Fig. 3B.

Signal voltage is supplied to the measuring circuit by the 6.3-volt secondary of a filament-type transformer, T. This voltage is regulated by means of wirewound potentiometer, R_2, which

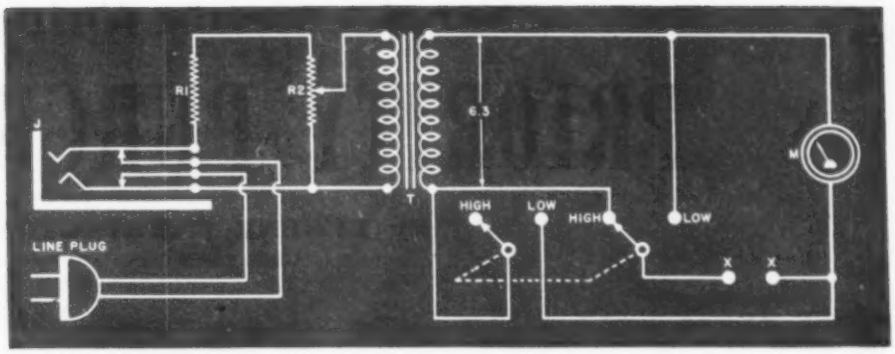


Fig. 2. Wiring diagram of the constructed impedance meter. The instrument combines both series and shunt principles, providing high and low measurements.

R_1—8000 ohms, 1 watt carbon res.
R_2—2000-ohm w.w. pot.—I.R.C. Type W-2000.
Sw.—Heavy-duty d.p.d.t. toggle sw.
T—6.3-v. fil. trans.—U.T.C. Type FT-4.
J—Junior double-circuit, "cold-frame" jack—Mallory 703-B.
M—0-1 rectifier-type a.c. milliammeter—Weston Model 301.

is the "zero-set" device of the instrument. When impedance measurements are to be made at the power-line frequency, the line plug is inserted directly into a 115-volt a.c. line outlet. When some other frequency (such as 400 or 1000 cycles) is to be employed, a phone plug, connected to the output terminals of a suitable audio oscillator, is inserted into jack J. If the oscillator output voltage is less than 50 volts r.m.s., it will be necessary to dispense with the limiting resistor, R_1.

Impedance measurements on most radio and amplifier components will be made at 400 or 1000 cycles, depending upon manufacturer's specifications. For some measurements, 60 cycles will be satisfactory. Calibration may be made at any frequency, and most experimenters probably will choose 60 cycles for this purpose. Accuracy of the impedance scale then will be tolerable at other frequencies.

Increased wide-range accuracy may be expected, however, if the calibration is made at some point (such as 500 cycles) near the center of the common measurement frequency range. This is because readings of the rectifier-type meter differ somewhat at various frequencies. In the range 60-to-1000 cycles, a .5% frequency error may be expected in the Weston Model 301 a.c. milliammeter. The meter reading decreases as the frequency increases.

If the builder desires, the impedance meter may be made somewhat more compact and self-contained by including a built-in 400- or 1000-cycle oscillator. Any oscillator circuit may be used, provided an r.m.s. output voltage of approximately 75 is delivered with good waveform. A suggested arrangement is the 6SQ7-6V6 resistance-capacitance-tuned oscillator (See RADIO NEWS, May, 1944, p. 70) followed by a 6V6 output amplifier. By means of resistance-capacitance switching, this circuit might be made operative at 60, 400, and 1000 cycles.

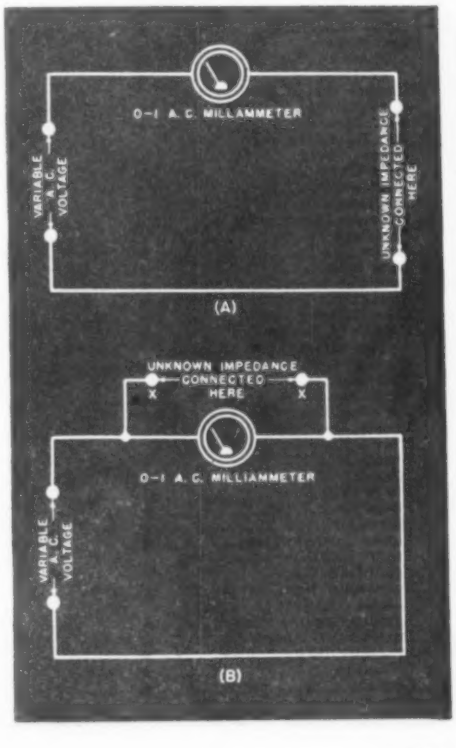
Mechanical Construction

The impedance meter is not of critical electrical design. No feedback or interaction are present in this circuit to affect operation. Mechanical construction therefore need not follow the inflexible rules laid down for other instruments. Individual builders may follow their own inclinations in the mounting of parts and general arrangement of the instrument.

The author's version (See Figs. 1, 2) is built in a 7" x 7" x 2" metal chassis as the instrument case. A 2-inch meter and miniature transformer will permit even smaller dimensions. The milliammeter, input jack, zero-set potentiometer, changeover switch, and "unknown" terminals are mounted on the front face (chassis top). The line cord passes through a grommet-lined hole near the bottom of one edge. Rubber bumper feet are fastened to the lower edge of the chassis and to the removable back plate to prevent table scratching. A convenient carrying handle (originally a drawer pull) is mounted on the top edge.

(*Continued on page* 154)

Fig. 3. Basic diagram of the series- and shunt-type direct-reading impedance meters.



Servicemen's Guide to

PRIORITY PURCHASING

By EUGENE CARRINGTON
Allied Radio Corp.

THE three questions most often asked by those service dealers not familiar with WPB regulations, are: 1. How can I obtain WPB approval to extend certifications for the purchase of parts and equipment I need? 2. What can I purchase under current WPB regulations? 3. How do I extend a priority certification? It is the purpose of this article to clarify these and other questions which most often confront the radio service dealer in connection with his purchasing procedure.

Many items needed for repair use can be purchased without any priority extension whatsoever. These are indicated in the table below under the heading L-265. A more detailed explanation of this WPB order will be found on page 41 under the heading Certifications and Procedure. See also notes 1, 2, and 4.

Other items, requiring priority certification, are indicated in the table below under CMP-5 and CMP-9A. Purchasing under these regulations requires only a written certification on your order. No specific WPB authorization is necessary. The only restriction is that you are a radio service dealer and that you are familiar with quantity limitations set up by WPB in the regulation applied. Copies of these and L-265 Limitation Order can be secured without charge from your WPB field office. You should obtain them and read each carefully so as to familiarize yourself with the scope and limitations involved. At the same time, obtain a copy of Priority Regulations 3, which contains a basic concept of the priority factors under which you operate.

A third grouping of items will require specific WPB authorization for procurement. Most of these are indicated in the table below, under WPB-541. See also notes 3 and 5.

Priority purchasing for the radio service dealer therefore, resolves itself down to the following: 1. What procedure or certification is required for a given item? The table below and special notes following will answer this question. 2. What is the text of the certification which must accompany your order under regulations requiring such procedure? This information is given in the paragraphs headed Certifications and Procedure. See page 41. 3. In what way are you limited as to the quantity or dollar value of your purchases? This question is best answered by a reading of the copies of Regulations 3, L-265, CMP-5, CMP-9A, and M-293 Scheduling Order which you can obtain from

(*Continued on page* 148)

PRODUCT TABLE

Product	L-265	CMP-5	CMP-9A	WPB-541	Note
Auto Aerials					1
Audio Transformers	★				
Ballasts	★				
Batteries					2
Battery Packs					2
Cabinets					
Wood	★				
Metal			★		
Chassis Bases		★	★		
Chokes					
Iron Core	★				
Air Core	★				
Coils (r.f., i.f.)	★				
Condensers					
Fixed	★				
Variable	★				
Copper Oxide Rectifiers			★		
Dial Belts	★				
Dial Plates	★				
Dry Rectifiers			★		
Fuses			★		
Grid Caps	★				
Hardware			★		
Insulators					1
Intercom Equipment				★	3
Inverters				★	
Jacks	★				
Jack Plugs	★				
Jack Switches	★				
Knobs (Molded)	★				
Line Ballasts	★				
Line-Cord Resistors	★				
Meters (Single Range)		★		★	
Microphones	★	★		★	
Microphone Stands		★			
Mounting Strips	★				
Padding Condensers	★				
Phono Cartridges					4
Phono Needles					1
Phono Pickups	★				
Pilot Lamps	★				
Plugs (a.c. line)					1
Plugs (jack type)	★				
Potentiometers	★				
Power Transformers	★				
Public-Address Equipment				★	3
Recording Discs	★				
Recording Needles	★				
Relays			★		
Remote Control Parts	★				
Resistors (Carbon)	★				
Resistors (Wirewound)	★				
Rheostats	★				
Sockets	★				
Solder					1
Soldering Irons		★			
Spaghetti	★				
Speakers (complete)	★	★			
Cone Assemblies	★				
Field Coils	★				
Suppressors	★				
Switches	★				
Test Equipment		★		★	5
Tone Controls	★				
Tools		★			
Transformers	★	★			
Trimmer Condensers	★				
Tubes	★				
Tuning Condensers	★				
Vacuum Tubes	★				
Vibrators (auto radios)	★				
Volume Controls	★				
Wire (Hookup)			★		

NOTES

Note 1. If this item is available from supplier's stock, no priority or certification is required. While most of these items have been discontinued from production, some are still produced but are available in limited quantities on a pro rata allocation basis.

Note 2. Available only in limited quantities on a pro rata allocation basis. No priority or certification necessary.

Note 3. Public Address and Intercom systems used for paging, transmitting information, emergency warnings, and for music during working hours, should be applied for on form WPB-541 where no construction is required for installation. If construction is required, form WPB-617 should be used. These forms should be filed by the ultimate user. The service dealer is then permitted to extend any priority granted for the purchase of this equipment. Consult your WPB Field Office for detailed instructions.

Note 4. New units not available. Old unit must be returned for repair or exchange. No priority or certification required.

Note 5. Test Instruments and Multi-Range Meters are covered by WPB Scheduling Order M-293, and require specific application on form WPB-3243 except for those instruments which from time to time are released as available under priority certification, in which case your order should be placed under CMP-5 Regulations. In emergency or cases where a higher priority is needed than that extended you under CMP-5 Regulations, application should be made to WPB on form WPB-541. Ask your WPB Field Office for a copy of M-293 Scheduling Order, Table 9, and WPB-3243 application which contains complete instructions for filing. WPB will also supply WPB-541 forms.

CERTIFICATIONS AND PROCEDURE

L-265 General Limitation Order. This order regulates the delivery of electronic equipment. Its basic stipulations are that no producer or supplier shall transfer electronic equipment to the consumer except to fill preferred orders (from the armed services and others operating in direct support of the war effort), orders rated at AA-5 or higher, or orders for electronic replacement parts where the consumer submits a defective or damaged part of similar kind and size which cannot be repaired or reconditioned. Where this is impractical, a signed certificate in the following form should accompany the order:

Consumer's Certificate—(To his Dealer)

I hereby certify that the part(s) specified on this order are essential for the presently needed repair of electronic equipment which I own or operate.

.....
Signature and Date

Supplier's (Serviceman's) Certificate—(To His Supplier)

I hereby certify that I am entitled to purchase the items specified on the accompanying purchase order under the provisions of Limitation Order L-265, with the terms of which I am familiar.

.....
Signature and Date

WPB-541 (former PD-1A) Application for Priority Assistance. This form can be used to apply for priority assistance which the applicant is not otherwise authorized to extend. It is to be used only where circumstances urgently require special assistance of importance to the war effort, such as replacement of equipment lost in a fire, etc. It is not to be used in such cases where Limiting, Scheduling, Conservation, or other such orders specify the use of other forms, however. It is best to consult with your WPB Field Office before making application on this form.

CMP Regulation No. 9A. This regulation sets up a procedure whereby the serviceman can purchase parts and controlled materials for making repairs or rebuilding a damaged or used item which he plans to resell. Such parts, however, must not be used merely to improve performance. This order does not include Capacitors, Microphones, Loud-speakers, Resistors, Volume and Tone Controls, Transformers and Tubes.

The following certification must accompany your order:

CMP Allotment Symbol V-3; Preference Rating AA-3. The undersigned purchaser certifies subject to the penalties of section 35(A) of the United States Criminal Code, to the seller and to the War Production Board, that, to the best of his knowledge and belief, the undersigned is authorized under applicable War Production Board regulations or orders to place this delivery order, to receive the items ordered for the purpose for which ordered, and to use any preference rating or allotment number or symbol which the undersigned has placed on this order.

.....
Signature and Date

CMP Regulation No. 5. This regulation sets up procedure for obtaining maintenance, repair and operating supplies, and minor capital additions not exceeding $500.00 for any one such addition. The following certification must accompany your order:

Preference Rating AA-5 MRO. The undersigned certifies, subject to criminal penalties for misrepresentation contained in section 35(A) of the United States Criminal Code, that the items covered by this order are required for essential maintenance, repair or operating supplies; that this order is rated and placed in compliance with CMP Regulation No. 5; and that the delivery requested will not result in a violation of the quantity restrictions contained in paragraph (f) of said regulation.

.....
Signature and Date

DIRECTORY OF FIELD OFFICES, WAR PRODUCTION BOARD

State	City	Number and Street
Alabama	Birmingham 1	1706 Second Avenue, North
Arizona	Phoenix	234 North Central Avenue
	Tucson	68 East Congress Street
Arkansas	Little Rock	221 West 2nd Street
California	Los Angeles 15	1031 South Broadway
	San Diego 1	530 Broadway
	San Francisco 3	1355 Market Street
Colorado	Denver 2	1755 Glenarm Street
	Pueblo	Fifth and Main Streets
Connecticut	Bridgeport 3	144 Golden Hill Street
	Hartford 4	119 Ann Street
	New Haven 10	152 Temple Street
Delaware	Wilmington 50	French and Water Streets
District of Columbia	Washington 25	
Florida	Jacksonville 1	314 West Monroe Street
	Tampa 2	608 Tampa Street
Georgia	Atlanta 1	127 Peachtree Street, N. E.
Hawaii	Honolulu 2	
Idaho	Boise	805 Idaho Street
Illinois	Chicago 6	226 West Jackson Boulevard
	Decatur 80	108 South Water Street
	Peoria 2	410 Main Street
	Rockford	303 North Main Street
Indiana	Evansville 8	112 Northwest 4th Street
	Fort Wayne 2	114 East Wayne Street
	Indianapolis 4	5 East Market Street
	South Bend 9	Michigan and Jefferson
Iowa	Davenport	326 West 3rd Street
	Des Moines 9	418 6th Avenue
Kansas	Wichita 2	106 South Broadway
Kentucky	Louisville 2	139 South Fourth Avenue
Louisiana	New Orleans 12	200 Barrone Street
Maine	Portland 3	142 High Street
Maryland	Baltimore 2	10 Light Street
Massachusetts	Boston 8	17 Court Street
	Springfield 3	1200 Main Street
	Worcester 9	340 Main Street
Michigan	Detroit 2	7310 Woodward Avenue
	Grand Rapids 2	60 Division Avenue, North
	Saginaw	124 South Jefferson Avenue
Minnesota	Duluth 2	120 North Fourth Avenue, West
	Minneapolis 1	407 2nd Avenue, South
Mississippi	Jackson 1	127 South Roach Street
Missouri	Kansas City 6	405 East 13th Street
	St. Louis 1	818 Olive Street
Montana	Helena	7 West Sixth Avenue
Nebraska	Omaha 2	405 South 16th Street
Nevada	Reno	106 E. Second Street
New Hampshire	Manchester	396 Canal Street
New Jersey	Newark 2	20 Washington Place
	Trenton	143 East State Street
New Mexico	Albuquerque	103½ West Central Avenue
New York	Albany 7	112 State Street
	Brooklyn 2	16 Court Street
	Buffalo 3	14 Lafayette Square
	New York 1	350 Fifth Avenue
	Rochester 4	119 Main Street, East
	Syracuse 2	224 Harrison Street
	Utica 2	185 Genesee Street
North Carolina	Charlotte 2	730 East Trade Street
	Raleigh	16 West Martin Street
North Dakota	Bismarck	202½ Third Street
	Fargo	322 Fifth Street, North
Ohio	Akron 8	106 South Main Street
	Canton 2	120 Tuscarawas Street, West
	Cincinnati 2	34 East 4th Street
	Cleveland 1	925 Euclid Avenue
	Columbus 15	145 North High Street
	Dayton 2	129 South Ludlow Street
	Lima	212 North Elizabeth Street
	Toledo 4	245 Huron Street
	Youngstown 3	16 Central Square
Oklahoma	Oklahoma City 2	407 North Harvey Avenue
	Tulsa 3	420 South Boulder Street
Oregon	Portland 4	520 Southwest 6th Avenue
Pennsylvania	Allentown	506 Hamilton Street
	Erie	16 E. 12th Street
	Harrisburg	112 Market Street
	Johnstown	216 Franklin Street
	Philadelphia 3	1617 Pennsylvania Boulevard
	Pittsburgh 22	511 Wood Street
	Scranton 3	207 Wyoming Avenue
Puerto Rico	San Juan	San Juan 46
Rhode Island	Providence 3	111 Westminster Street
South Carolina	Columbia 56	1306 Senate Street
South Dakota	Sioux Falls	133 North Main Avenue
Tennessee	Knoxville 010	521 Market Street
	Memphis 1	8 North Third Street
	Nashville 3	234 Third Avenue, North
Texas	Dallas 2	106 South Ervay Street
	El Paso	306 East San Antonio Street
	Houston 2	1016 Walker Avenue
	San Antonio 6	310 South St. Mary's Street
Utah	Salt Lake City 1	36½ West 2nd Street, South
Vermont	Montpelier	84 State Street
Virginia	Norfolk 10	236 Granby Street
	Richmond 13	703 East Franklin Street
Washington	Seattle 1	1318 Fourth Avenue
	Spokane 8	1023 West Riverside Avenue
West Virginia	Charleston 30	1031 Quarrier Street
Wisconsin	Eau Claire	128½ Graham Avenue
	Green Bay	206 Main Street
	Madison 3	119 East Washington Avenue
	Milwaukee 1	161 West Wisconsin Avenue
Wyoming	Casper	202 E. 2nd Street

WIRED-RADIO INTERCOM

By
RUFUS P. TURNER
Consulting Engineer, Radio News

Employing carrier-current principles, a pair of units, as described in this article, may be used for interoffice communications over available power lines. No special wires need be run.

THE wired-radio type of intercommunicator has one advantage that makes for strong initial appeal. That is, special lines do not have to be strung for its operation. This unit sends and receives modulated radiophone signals over the power line by way of the same plug through which its operating voltage is obtained. Economy, simplicity, and ready portability are afforded by use of the carrier-current principle.

The two leading disadvantages which heretofore have discouraged the private building of wired-radio intercommunicators are line hum and noise interference, and lack of privacy. The first is due to the fact that when the power line is employed as a radio-frequency transmission line, some hum and noise voltage is coupled into the detector and high-gain audio stages. Lack of privacy results from the fact that nothing is to prevent any individual from coupling a satisfactory receiver or intercommunicator to the power line and eavesdropping on a conversation. This may be done at an appreciable distance from the building in which the intercommunicator system is located.

In common with other experimenters, the writer has found that a 300-cycle high-pass filter will reduce materially the interference from the line-frequency and its principal harmonics. This component likewise will deaden a number of the noise peaks, although a *simple* 100% effective noise eliminator for the wired-radio intercommunicator has not yet been produced. The "wireless" unit will, even in its most refined state, exhibit a noise level somewhat higher than that noted in wire-connected intercommunicators. Privacy, the second attribute to be desired to the extent at least of keeping conversations within the office or building of origination may be obtained, as will be shown, by installing in the power line band-suppression filters (tuned to the intercommunicator frequency). The filter will be installed preferably at the service box where the power line enters the office or building.

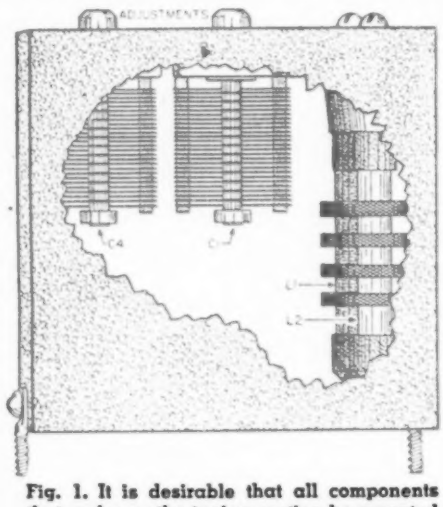
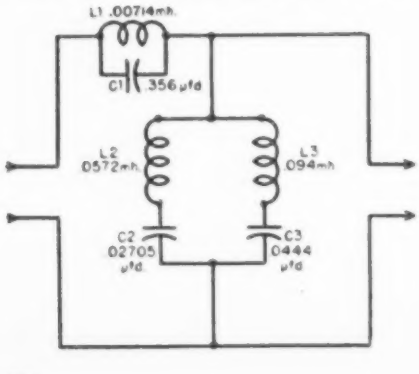


Fig. 1. It is desirable that all components that make up the tuning section be mounted within a metal enclosure, as shown.

Fig. 2. Privacy filter, when used, will confine all communications to the desired section of an office or a building.



The intercommunicator described in this article employs a full carrier-current system; it may be operated on a.c. or d.c., is completely connected when the power plug is inserted into an outlet, and has sufficient power output when transmitting, and detector sensitivity when receiving to permit communication over very nearly one-half mile of power line on one side of the electric meter. The unit is easy to operate. The small permanent magnet dynamic speaker serves as both loudspeaker and microphone. A single, 3-position switch enables the operator to change over from transmitting to receiving or calling.

Circuit Description

The complete schematic for the intercommunicator is given in Fig. 4. From this drawing, it will be seen that plate and screen voltages are supplied by the 25Z5 or 25Z6G tube which acts as a line rectifier on a.c. and as a low resistance on d.c. The unit may be connected to any 115-volt line, except that some precaution must be taken, as will be explained later, when the building has three-wire service. Also, the line plug must be inserted into a d.c. outlet in such a manner that the 25Z5 plates will be connected to the positive side of the line.

The tube heaters are connected in series in the order shown and connected across the power line through a 112-ohm line-cord resistor. The changeover switch (S_1-S_2-S_3-S_4) is a 4-pole, 3-position selector switch which may be of either the rotary or lever type. The switch is wired in such a way that the *call* position is on one end, to prevent unintentional transmission of the calling signal when changing over from transmitting to receiving, or vice versa.

The tubes, reading from left to right, act as detector, high-gain a.f. voltage amplifier, and output a.f. power amplifier (when receiving) and as r.f. oscillator, speech amplifier, and modulator (when transmitting). When calling, the transmitting circuit is employed.

When the changeover switch is in the transmitting position (T), the first 25L6G tube acts as a 100-kc. oscillator. The second 25L6G plate is connected in parallel with that of the first tube for Heising modulator action. The 6SJ7 then becomes a high-gain speech amplifier. The high-turns winding of the loudspeaker transformer is shifted to the grid of the 6SJ7 tube and the speaker thus becomes the microphone. The signals delivered by this type of dynamic microphone will be found entirely intelligible for communication purposes.

The 100-kc. carrier frequency is determined by L_2 (a 2½-mh. pi-wound r.f. choke) tapped between the second

and third pi's from the bottom ("B"-minus) end. Connected in parallel with this coil are the two capacitors, C_3 and C_4. C_3 is a .00095-μfd. silvered mica unit, and C_4 a 100-$\mu\mu$fd. air trimmer. At 100 kc., C_4 will be set at approximately half scale. R.f. energy is coupled into the power line by means of a series resonant circuit. This is composed of L_1, a second 2½-mh. pi-wound r.f. choke, mounted close beside the other and tuned by an identical combination of fixed and variable capacitors, C_1 and C_2.

When transmitting, the preset voltage divider, R_2, is connected into the circuit by the changeover switch to supply the proper screen voltage for oscillation in the first 25L6G.

Capacitors C_{11} and C_{12} and choke coil L_4 comprise a high-pass filter of the constant-K type. This unit, with a cutoff frequency of 300 cycles, minimizes hum transmission through the audio stages and attenuates some of the noise components. The effect of this filter upon the male speaking voice is not deleterious.

When the changeover switch is in the receiving position (R), the first 25L6G tube becomes a regenerative detector, the 6SJ7 the first audio, and the second 25L6G the audio output tube. The speaker is connected to the plate of the latter tube through capacitor C_{14}.

In the receiving position, another preset voltage divider, R_3, is cut into the first 25L6G circuit by the changeover switch. This resistor is set beforehand to give proper voltage for a reasonable amount of regeneration without oscillation.

Audio-gain control R_6 is preset for the most satisfactory volume level when receiving. This setting usually will be suitable also for transmitting (since the circuit has considerable modulation capability) and need not be shifted in adjustment unless the operator must talk at a distance from the "microphone."

When the changeover switch is in the calling position (C), the entire circuit is arranged, as before, for transmitting, except that the speaker is removed from the circuit entirely and a small amount of audio voltage is fed back from the plate of the second 25L6G to the grid of the 6SJ7 through capacitor C_8. This produces an audio tone signal which is reproduced by the distant intercommunicator.

In order to make calling by means of this tone signal reliable, each intercommunicator unit must be switched to the receiving position when not in use. Each then will be in condition to reproduce the call signal and attract the attention of the operator. If the changeover switch is of the spring lever type, it should be wired in such a manner that when it is released the spring will return the poles to the receiving position.

The rather large radio-frequency

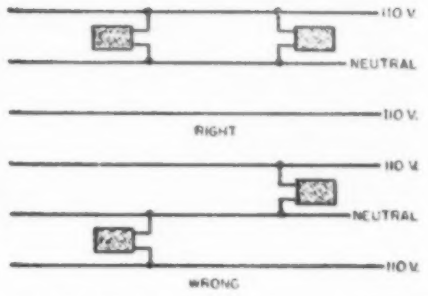
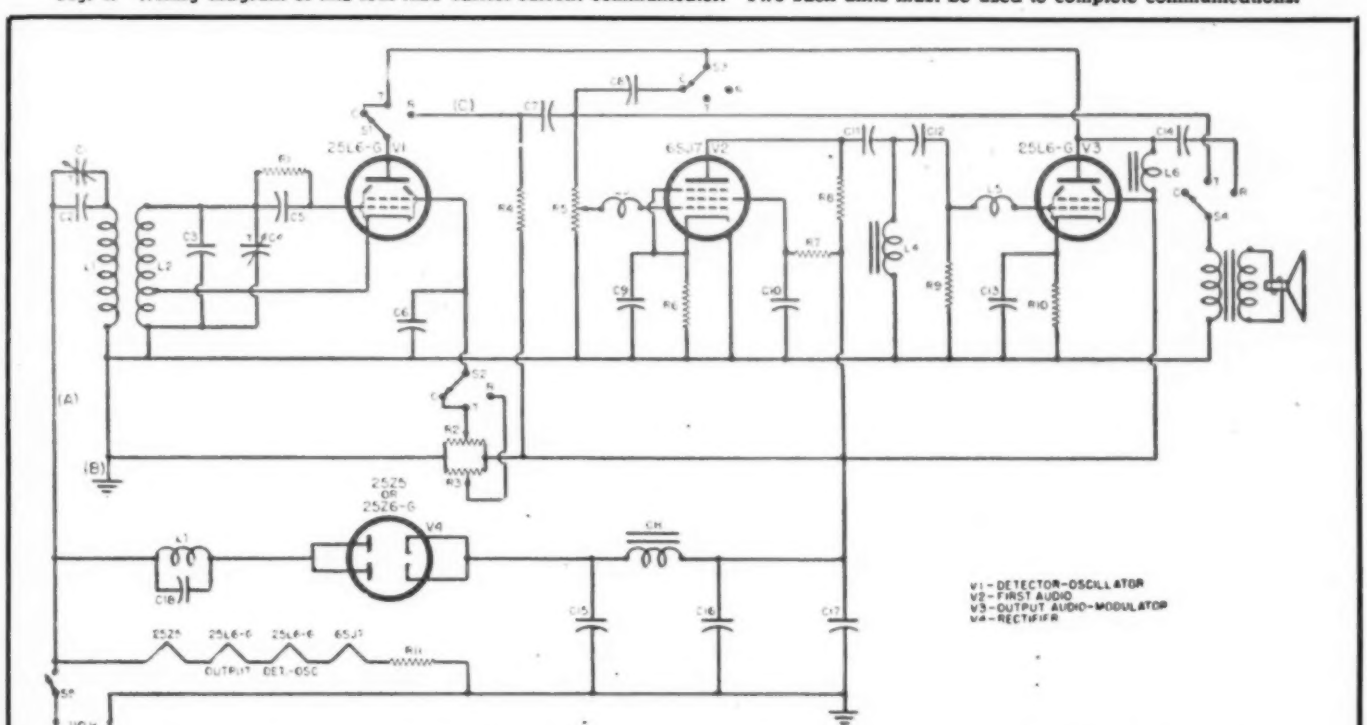


Fig. 3. Showing right and wrong ways of connecting wired-radio intercommunicators when three-wire systems are employed.

chokes, L_3 and L_4, serve to keep r.f. energy out of the audio stages where it would cause distortion. These are chokes of the same size employed in some of the older tuned r.f. broadcast receivers (50 mh.) and are not difficult to obtain. Capacitor C_{17} serves a similar purpose and should be mounted as close as possible to the electrolytic section, C_{16}. Radio-frequency voltages and currents are prevented from entering the rectifier and finding their way back into the circuit by the wave trap (L_7-C_{18}). This trap is tuned to 100 kc., and the fixed tuned arrangement shown in Fig. 4 will be found satisfactory if close tolerance coil and capacitor are employed.

It is highly desirable that the entire tuning section be mounted within a shield can. Fig. 1 shows how the

Fig. 4. Wiring diagram of this four-tube carrier-current communicator. Two such units must be used to complete communications.



C_1, C_4—100 $\mu\mu$fd. air trimmer cond.—Hammarlund APC-100
C_2, C_3—.00095 μfd. silvered mica cond.
C_5—.0001 μfd. mica cond.
C_6, C_7, C_8, C_{10}, C_{14}, C_{17}—.01 μfd., 200 v. tub. cond.
C_9—1 μfd., 200 v. tub. cond.
C_{11}, C_{12}—.053 μfd. cond. (see text)
C_{15}—10 μfd., 50 d.c. w.v. elec. cond.
C_{16}, C_{16}—40 μfd., 200 d.c. w.v. elec. cond.
C_{18}—.0025 μfd. mica cond.
CH—10-20 henry, 100 ma. midget filter choke—U.T.C.
L_1, L_2—2½ mh. pi-wound r.f. chokes—National R100-U
L_3, L_5—50 mh. r.f. chokes—Miller 858
L_4—2.65 henry iron-core choke (see text)
L_6—20 henry, 75 ma. midget filter choke—U.T.C.
L_7—1 mh. pi-wound r.f. choke—National R300
R_1—15,000 ohm, 1 w. res.
R_2, R_3—20,000 ohm, 5 w. res. (with sliders)—Ohmite
R_4—20,000 ohm, 100 w. res.—Ohmite
R_5—½ meg. pot.—I.R.C. Type CS
R_6—3500 ohm, 1 w. res.
R_7—1½ meg., 1 w. res.
R_8, R_9—½ meg., 1 w. res.
R_{10}—125 ohm, 5 w. res.—Ohmite
R_{13}—112 ohm line cord res.
S_1, S_2, S_3, S_4—4P3P changeover sw.
S_5—S.p.s.t. toggle sw.
Speaker—5" p.m. dynamic—Cinaudagraph RM5

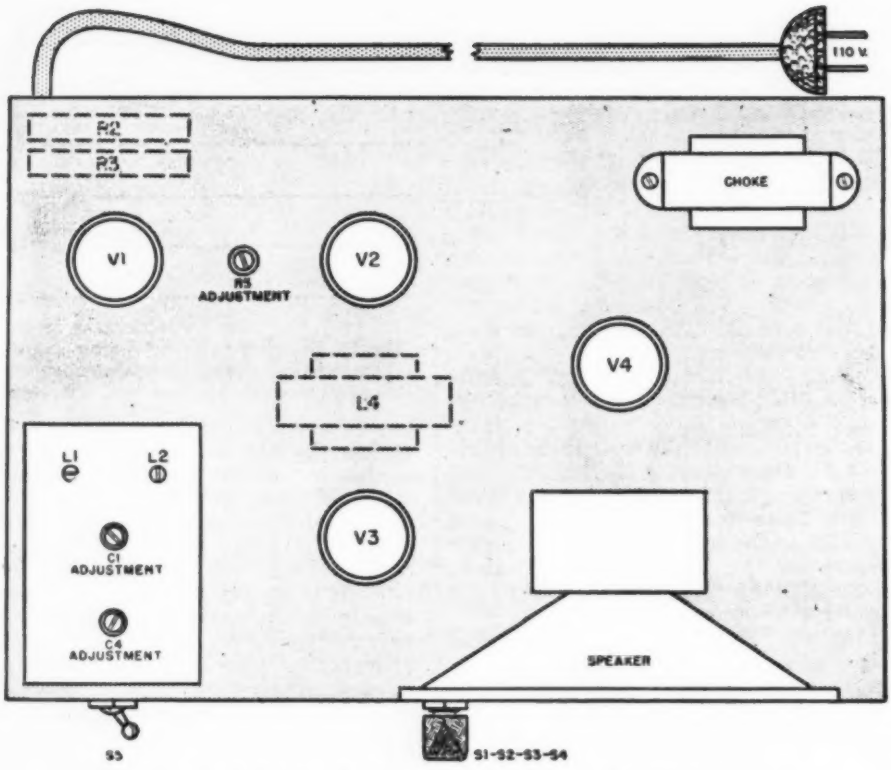


Fig. 5. Chassis layout, showing proper placement of component parts.

two pi-wound coils of the coupler (L_1 and L_2), and the air trimmers (C_1 and C_4) may be arranged within a 3" x 2" x 3" metal box provided with spade screw feet for mounting securely on the intercommunicator chassis. The fixed capacitors C_2 and C_3 are mounted directly to the air trimmers C_1 and C_4 within the shield can.

The coils are National type R100-U chokes which are supplied with ceramic standoff mounting insulators. The latter may be secured to the top of the shield box by means of 6-32 screws and the chokes hung downward. The trimmers are Hammarlund type APC-100 units which likewise may be mounted inside the top of the box and hung downward. For good coupling, the two chokes must be mounted exactly parallel to each other and as close together as physically possible.

The "regeneration" and "oscillation" resistors (R_2 and R_3) are 5-watt wirewound units with sliders for close adjustment. The latter are set carefully, as explained under *Adjustment*.

It is not likely that L_4 will be obtainable in the 2.65-henry value required in the filter. This component accordingly will have to be improvised by removing turns from a larger choke, of say 5, 7, or 10 henries inductance. An inductance bridge may be used to check progress of the "inductance peeling"; or better still, the choke may be checked in the actual filter, as will be explained under *Adjustment*. The author favors the latter method, since it reveals the actual performance of the filter as choke turns are adjusted in number. It is this performance, rather than some finite value of inductance, which matters most.

The capacitors employed in the high-pass filter likewise are off-standard as regards their capacitance. They are both of the same value and may be made up, however, of standard units connected in parallel. A suitable arrangement would be an .05-μfd. oil tubular capacitor in parallel with a .003-μfd. silvered mica unit. Each of these parallel combinations (C_{11} and C_{12}) must be adjusted, or chosen carefully to have the same capacitance value.

The Heising modulator choke, L_6, should have as high an inductance value as possible, consistent with the restricted space in which it must be mounted and with the relatively high plate current of the 25L6G tube. Actually, a 20-henry, 75-milliampere midget receiver choke will be satisfactory in this position.

The loudspeaker diameter need not exceed 5 inches. However, smaller sizes will give poor tone quality and are not recommended for that reason. If a permanent magnet dynamic speaker is not available, an electrodynamic unit may be used, provided some form of field supply is incorporated in the circuit. In most cases, it will be sufficient to substitute the field coil of the speaker for the filter choke, CH, to obtain d.c. excitation. But if the field resistance is too high to permit such a connection, the 25Z5 cathodes may be separated, and the field winding may be connected between the free cathode and ground.

Layout of the unit is simple and compact. The entire intercommunicator is mounted on a 7" x 10" x 2" metal chassis and may be enclosed in a midget radio cabinet of the same size. The latter may be wood or metal, as personal taste and availability dictate. There is sufficient "breathing space" on and under the chassis, but individual builders may prefer a more compact layout than the one shown in Fig. 5. If the unit must be *compressed* in order to fit it into an available cabinet, it will be permissible to reduce the chassis size and parts arrangement, as long as the standard rules applicable to construction of midget radio sets and small high-gain amplifiers are followed.

The shield box, housing the oscillator and coupling coils and the attendant capacitors, is mounted in the front left corner of the chassis. The line cord leaves the back of the chassis directly behind this shield box. In this way, a short coupling lead is obtained between coupling capacitor C_2 and the power line. Trimmers C_1 and C_4 are set by means of slotted shafts for screwdriver adjustment.

The iron-core chokes, CH, L_5, and L_6, must not be mounted so close together that their fields interlock. It is suggested that L_4 be mounted under the chassis between tubes V_3 and V_2, as shown in Fig. 5. CH then may be mounted on top of the chassis in the right rear corner. L_6 is mounted below the chassis beneath the speaker, with its core at right angles to that of L_4.

Gain control R_5 is provided with a slotted shaft for screwdriver adjustment and is mounted through the top of the chassis and as close as practicable to the 6SJ7 tube, V_2. The high-gain characteristic of the first audio stage may necessitate shielding of all components in that stage, particularly if a very compact layout is employed. In such case, it will be advisable to mount all of the components (C_9, C_{10}, R_5, R_6, R_7, R_8, and L_5) as close as possible to the 6SJ7 socket and then to cover them with a heavy metal shield can. Holes drilled around the can will permit easy access for the leads.

It will be found advantageous to use a metal bottom plate on the chassis to complete the shielding. This refinement aids materially in the reduction of stray pickup when receiving and radiation when transmitting and calling.

The tube lineup shown in Fig. 4 is not mandatory. Other available types having similar characteristics may be employed if corresponding changes are made in the values of cathode, plate, screen, and line-cord resistors. Assuming the rectifier tube to remain the same; other suggested tube lineups include 25A6-6J7-25A6, 43-57-43, 50L6G, 12SK7-50L6G, etc.

Nor is the carrier frequency of 100 kc. imperative. This frequency was chosen as a low value for which tuning components are readily available. The individual builder is reminded, however, that low frequencies give best results and that the carrier should not exceed 200 kilocycles. Other tuning and oscillating arrangements likewise are applicable if the builder wishes to introduce a few of his own ideas. For instance, a two-coil regen-

(*Continued on page* 90)

LET'S TALK SHOP

With JOE MARTY

Eastern Editor RADIO NEWS

A GREAT deal has been said in recent months in this and other publications concerning servicemen. Perhaps the time is now ripe for a complete stock-taking of the position in which the radio serviceman finds himself.

At the present time most servicemen are in an enviable position as regards quantity of work. It is no longer necessary to advertise for customers, nor does it seem necessary to even exercise common courtesy in dealing with these customers. Since this is to be a factual record of the present status of the radio serviceman and his industry, a little plain speaking is not out of order. Primarily, most servicemen with whom I have spoken are suffering from overconfidence. These men seem to feel that the present state of affairs is going to last indefinitely. I should like to free your minds of the hallucination that this is the case.

It seems that as soon as the war has progressed far enough to permit the manufacture of civilian radio sets the volume of repairs will show an appreciable drop since most of the sets which are in the repair shops today are of the midget variety on which the owners have spent in repairs far more than the sets are worth. Many of these sets have been so changed as to basic circuits that it will involve a considerable expenditure of time and money to put them back into their original condition; in some cases this will not be possible at all. Obviously, if the cost of a new receiver of a comparable type is approximately the same as the cost of repairing the old one, the customer will buy a new set.

Most of the servicemen operating shops today have no ultra-high-frequency technique at all. They do not own any of the new high-frequency test equipment nor have they been trained in its use. If, as present conditions indicate, we are to have an entirely new radio picture after the war in which high-frequency equipment will be in the majority, it is obvious that the present serviceman is not in any too good condition to cope with these new sets. While the present high volume is very gratifying, a great majority of these sets are sitting in the serviceman's store waiting for tubes and parts.

According to recent government announcements it does not look as though there will be available at any time in the near future enough tubes to service even 25 percent of the sets which you would ordinarily be called upon to service. The parts situation, particularly as regards transformers, is also extremely critical. There does not seem to be any well-informed opinion in the industry which will permit the making of a reasonable guess as to when these parts will be available. All of these things militate against your profitable operation since it is obvious that if the set can't be delivered to the customer, the serviceman cannot collect for it.

Another thing which makes the serviceman's picture look very rosy at this time is the lack of competition. There are less than 25 percent of the servicemen of 1939-1940 who are still in business. The younger men in the industry, as well as those highly trained, have been absorbed into the government services either in the Army, Navy, or into war work. This tends to give a false picture which should be taken into consideration in planning future operations.

In the postwar picture we have a very disturbing fact to consider and that is the large number of men who will want to get into the servicing business after the war. There have been some two million men trained by the government in some phase of electronics. If only one percent of these servicemen desire to enter the radio-servicing field after the war, that will mean an increase in its population of 20,000 men. This is about the figure of good servicemen who were in the market before the war.

Another factor which should be considered very carefully in any of your postwar plans is this: Most of the dealers, in fact 85 to 90%, plan to have a service department since many of the new devices such as television, facsimile, etc. will require a continuing service after installation. Most dealers, of necessity, must maintain a service department. The retail radio dealer has learned the lesson during the war that a service department is not a liability but can be made into a very profiitable investment by proper operation.

The independent serviceman will find that this competition by the dealer and his serviceman will very seriously interefere with his operation postwar-wise.

Another element which will further plague the serviceman is the problem of a price war. Many of us have seen this type of thing over a period of many years in the radio industry. There is nothing that I can say that will prevent such a price war when there are so many servicemen competing for the same customer's business.

Another factor which will cause trouble in your postwar operation is the government aid which will be given to returning servicemen who desire to start and operate their own businesses. As you know, financial assistance as well as priority assistance is given to these returning veterans to enable them to start their own businesses. No serviceman will object to this in view of the sacrifices that these men have made; nevertheless, in the operation of a business all elements both good and bad that affect that business must be taken into consideration.

The above facts should prove to the thinking serviceman that his future

(*Continued on page* 100)

"The crisis is passed, Mr. Smitters. I'm going to be able to fix it!"

Practical laboratory work with Signal Corps equipment ensures technical knowledge of radio operation.

G.I. PLANS for POSTWAR SHOP

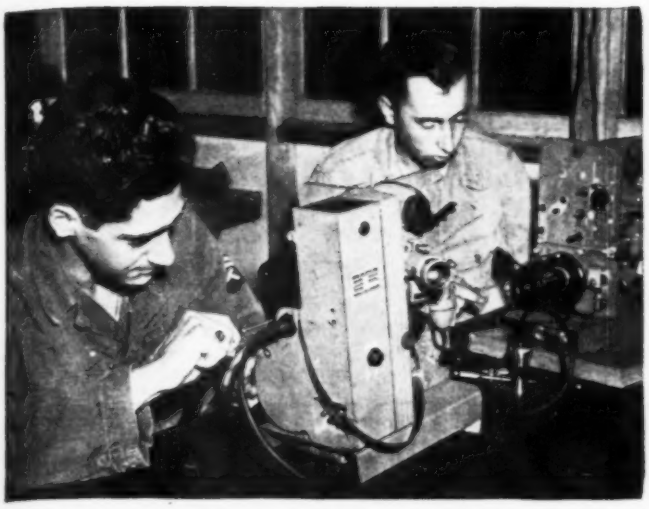
By HAROLD F. HETRICK

Important facts on Government financial aid and guidance available to all returning veterans who plan to open their own radio shops.

WHEN the shooting is over, Sergeant Charles Brown, 26, Army radio repairman now on active duty in France, will be given a chance to learn the "facts of life" about the radio repair business, his chosen postwar occupation. Armed with a G.I. business property loan, an Army business management course, and boundless energy and enthusiasm, Charles expects to open a radio repair shop when discharged. Why did he choose the radio business? How many veterans will enter the same field? Will they succeed? Where will they locate?

Thoughtful radio men, bankers, and civic minded people interested in the veteran and their community are asking these questions everywhere. A recent survey showed that three of every ten veterans discharged from the Army wanted to go into business for themselves. Uncle Sam has already taken several steps to aid veterans like Charles to open a radio repair shop or any other field of their choice: (1) Government agencies are preparing G.I. study books on business management in various fields and (2) under Section 500 of the G.I. Bill of Rights honorably discharged veterans are given Federal aid in securing loans for purchase of business property.

The Department of Commerce at the request of the Army Education Branch, War Department, is preparing some twenty books on business operation for distribution to men in all services before being discharged. Requests for manuals have poured into the Department from all over the world, from Alaska's ice-bound outposts to sun-parched tent cities in the South Pacific. Letters come from Lieutenant Colonels and from buck privates. They arrive by V-mail, air mail, and ordinary post. They ask: "What government aid can I get in financing a small business?" "How



Knowledge obtained in repairing projectors and photographic equipment can well be applied to many phases of radio.

Many prewar servicemen have gained valuable additional knowledge in repairing and maintaining military equipment.

can I learn more about the lines which I am now considering?" Before the war is ended the G.I. books will aid servicemen in selecting the type of businesses that best suit their experience, education, and talents.

Although the books will not be ready for sometime, the veteran, whether in the Army or Navy, on active duty (latter from Educational Services Section, Training Division, Bureau of Naval Personnel, Navy Department, Washington) may obtain a copy through the Armed Services Institute, Madison, Wisconsin, a sort of International Correspondence School on a global basis. This organization, in addition, offers an astounding total of 7000 courses available at a nominal cost. Discharged servicemen, as well as interested civilians, may obtain the same manuals, but not until they have been released by the Army and revised by the Department of Commerce for general distribution through the Superintendent of Documents.

When the Sergeant receives his G.I. book, before being discharged, he may be guided expertly through the material by competent instructors sent abroad by the Army or, if in an isolated area, he will study the material himself in the manner of a correspondence course. When he turns to the first section of the radio and electrical shop manual, he will find a list of questions: "Had he ever had previous selling or radio repair experience?" "Could he tell a condenser from a transmitter?" "Would he be willing to spend 14 hours a day to gain a foothold in the radio business?" If his answers are negative the chances are that he does not belong in the radio repair game. The manual deals mainly with business management problems, previous technical radio experience being assumed, covering arrangement of window displays, buying advertising space in local papers, maintenance of proper records, how to take stock, how to choose a store location, how to train salesmen, credit problems, and various other operational problems.

All material, very practical in content, was prepared with the close cooperation of trade associations as well as successful businessmen in the electrical appliance and radio repair field. Books are written with so much punch that one of the Armed Service Institute's professors was so smitten with the "go-into-business for yourself" bug that he deserted his lecture hall for a shop on Main Street. Too much publicity on the G.I. books has been avoided by interested government agencies in order to forestall an avalanche of requests before the books are off the presses.

It is naturally assumed by government agencies preparing the G.I. study aids that only veterans with previous experience will enter, let us say, the radio repair field. A survey of 20,000 enlisted men made by the Army Service Forces last summer disclosed that 80 per cent have had previous experience in the field they expect to enter. About half were self-employed before entering service. However, letters received so far by the Small Business Division (Commerce) from servicemen might indicate otherwise. As one soldier's letter says: "I would appreciate your sending me the list of books on how to operate 20 different kinds of small enterprises as I will then be in a position to decide which book or books I would like to obtain." Each veteran will need careful guidance from interested local Chambers of Commerce, trade associations, and business men in order to provide adequate guidance into the right field.

Of course, there is a traffic cop with final authority to slow down the rush of veterans who might be stampeded into business. This man is the local

(*Continued on page* 122)

Radio men operating an SCR-193 during the invasion of Los Negros Island. These men had their equipment in operation within fifteen minutes after the landing.

The author points out the various sources of radio interference that are prevalent in automobiles, and methods for their elimination.

Servicing Hints on AUTO RADIO INTERFERENCES

By M. S. KAY

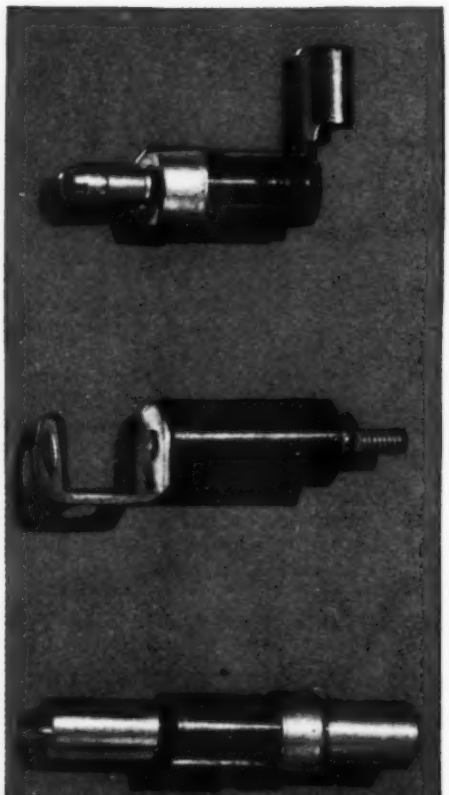
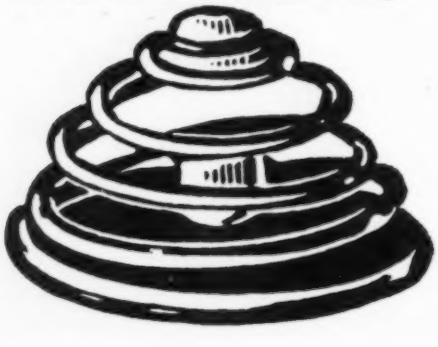


Fig. 1. Commercial resistor-type suppressors, used to eliminate ignition interference.

Fig. 2. Coiled spring, mounted directly under hub caps, will suppress wheel interference in the form of static charges.



THE automobile receiver, due to its position, is constantly subject to a host of disturbances, certainly much more than one finds in the home radio. One of the greatest sources of interference is the automobile motor itself. Here is found an extensive electrical system that affects almost every section of the car chassis and is certain to cause trouble unless adequate (and sometimes elaborate) measures are taken to protect the receiver.

Take the ignition system, for example. Here a continuous and rapid breaking of the direct current takes place in order to develop the spark necessary for the operation of the gasoline motor. This gives rise to a high-frequency "hash" which is quite similar to power supply vibrator disturbances.

In the late car models before the war, automobile engineers took pains to see that this source of interference was minimized and this has simplified the installation of radio receivers immeasurably. There was also the tendency on the part of the car manufacturer to install sets at the factory, which led to the development of sets designed especially for that model car, and this resulted again in less trouble. There is no reason why this condition will not continue after the war.

For the present, however, the serviceman must deal with radios that were not particularly designed for the car in which they are installed and here methods and procedures must be evolved that will reduce any annoying interferences to the point where they will not interfere with the enjoyment of the set.

High on the list of preventive measures lies shielding of the radio set proper. This generally takes the form of a well built, good-conducting case into which the radio chassis is mounted. Screws and soldered connections place the radio frame at the same potential as the case and a tight-fitting cover completes the installation of the apparatus. The case is now securely fastened to some portion of the bulkhead of the car and here again good electrical connections are required. To accomplish this, bonding is resorted to. This type of connection offers very little resistance and is easily soldered to make a secure connection. However, for the grounding to be of any use, all metal sections of the automobile chassis and body must also be electrically in contact with each other. In car models built prior to 1937 this was not the case and here it remained for the serviceman to go through a long, tedious procedure of using the above-mentioned copper braiding to bond the more troublesome parts together. In more recent models, the automobile engineers have modified the car bodies so that better electrical contact is had throughout.

Nonetheless, even with this improved electrical construction of the more recent cars, it is still advisable for the serviceman to check each of the following points when installing auto sets or repairing those that are troublesome:

1. Muffler and exhaust pipe.
2. Wheels.
3. Steering column.
4. Hood.
5. Rear Springs.
6. Engine.

A good example of interference being generated due to poor electrical connections concerns the accumulation of static charges on the wheels of a car, especially the front ones. The electrons resulting from this charge are unable to flow easily to the car axle through the wheel bearings due to the accumulation of dirt and grease at this point. When this charge builds up to a sufficiently high value, it will suddenly discharge in

the form of a spark. This will be picked up by the antenna and cause the same type of interference in the set that a sudden flash of distant lightning might. The only effective way of eliminating this noise is to provide a good electrical path for the electrons before they are able to build up to sparking proportions. The solution generally consists of placing a coiled spring, such as shown in Fig. 2, between the hub cap and the axle. The pressure exerted by the coiled spring then keeps this device in good contact between the cap and the axle at all times and provides the necessary path.

A problem frequently encountered in auto radio repair work consists of determining whether the source of interference arises from the engine and its electrical system, or from the static discharges across poor electrical connections at various sections of the car. A simple solution lies in taking the car out on the road and shutting off the ignition and any other electrical devices on the car (except the radio) and hearing whether the disturbance still persists with the vehicle in motion. The indication is even more positive if the interference is of a short staccato form.

One ingenious method that has been employed to determine which part of the car is responsible for these noises uses a small portable antenna attached temporarily to the receiver in place of its regular one. This is now moved back and forth until the indication is greatest. Many repair hours may be saved this way. While not specifically mentioned, a location that is free of any manmade disturbances is presumed.

To add to the complications of auto radio servicing, many formerly secure connections become loose as a result of the continuous vibration to which every section of the car and its attached accessories are subjected. The indication is scratching noises in the speaker and as can be easily arrived at, is due to the connection alternately making and breaking the line of contact.

Oxidation and corrosion of metallic surfaces may readily give rise to high-resistance connections where low-resistance paths are necessary. Should this occur at a ground attachment, then the set will no longer be grounded and the shielding will act as an antenna. These, too, then must be investigated in case of trouble. A good practice in the case of shielded cables running to the battery or other parts of the car, is to bond all of these together and then ground them at one point rather than using separate grounds on every lead, each having its own soldered point of connection with the chassis of the car.

Within the receiver itself, shielding and grounding at all necessary points are doubly important, for it is here that disturbances have their greatest effect. In a well-designed receiver, the power supply is placed in a separate compartment and kept as far as possible from the high-gain circuits. Heater leads are provided for by grounding one end at the socket itself, while the other is carried in a shielded wire. Either metal tubes are used or the glass tubes of high gain are covered with close-fitting metallic shields. Here again we may encounter troublesome operation if any ground connections work loose because of the vibration of the car.

From a practical standpoint, it is generally better if there is a clean break in the wire, rather than a connection that is still able to make contact with the point that it was connected. With the former, a silent receiver is the result and a serviceman will instinctively attack the set proper. Even if the trouble is not with the set itself, but some adjoining wire such as a battery lead, it would take a good serviceman about ten minutes to localize the fault.

On the other hand, suppose we have an intermittent source of trouble. Then it may show up immediately but chances are that it would not, if past experience is any guide. The procedure from here on would probably include playing the set for a while, moving it about while it is on, or even installing it back in the car and taking it out for a road test. However one attacks the problem, the past ex-

(*Continued on page* 104)

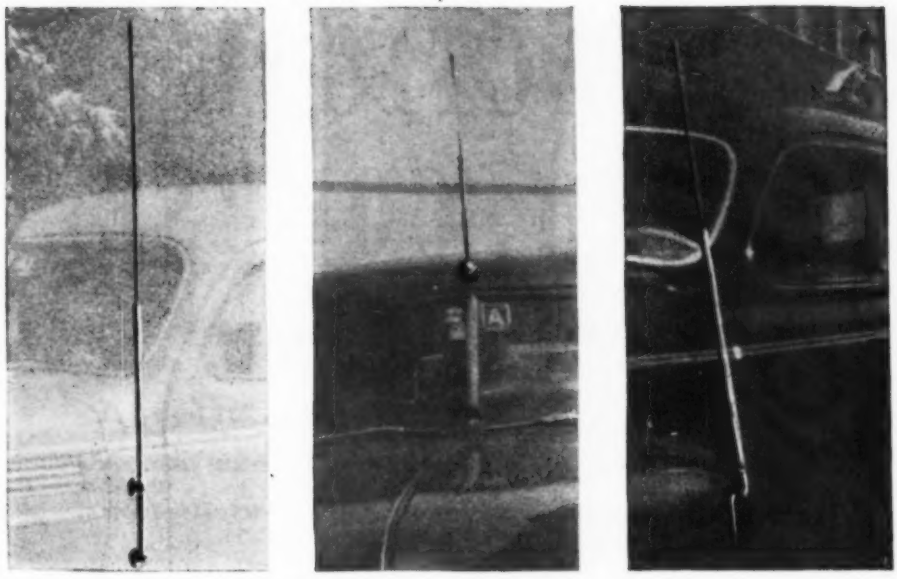
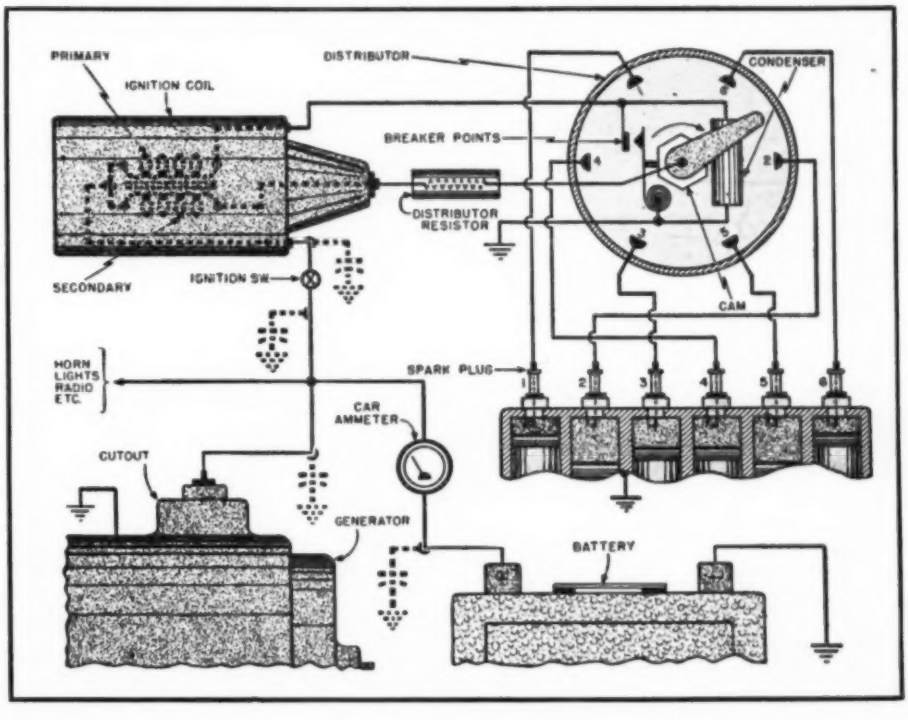


Fig. 3. Various methods employed by the industry for mounting automobile radio antennas. The antenna should be well shielded from motor interference and placed away from the body of the car to obtain maximum pickup efficiency.

Fig. 4. Wiring diagram of the ignition system of an automobile, showing the placement of the fundamental components. There are several wiring variations depending on the make of the car; however, the general principles are the same.



PRACTICAL RADIO COURSE

By ALFRED A. GHIRARDI

Part 33. We can now add the vacuum tube to the oscillating tank circuit covered in last month's lesson in order to produce sustained oscillations.

TO LEARN how the self-excited vacuum-tube oscillator operates, it will be necessary to understand the various actions that occur in the tank, grid, and plate circuits. Throughout the discussion which follows, it should be remembered that though these actions must necessarily be described here independently, they actually are related to each other, and many of them take place simultaneously in the oscillator.

Operation of Simple Vacuum-Tube Oscillator

Let us continue with our study of the basic tuned-grid tickler-feedback type of oscillator discussed in last month's article and illustrated again here in Fig. 1.

To set the circuit in operation, the filament current is turned on and the plate voltage is applied. When the plate voltage is first applied, the grid is at zero potential (this circuit condition is represented by point *A* on the plate current-grid potential characteristic curve of the tube in Fig. 2). The circuit action then is as follows:

(1) Plate current i_{p_1} (Fig. 2) starts to flow through tickler coil L_t, creating an expanding magnetic field around it. This expanding field cuts across the turns of tank coil L, inducing a voltage pulse in it.

(2) This acts as the *beginning* of the initiating impulse that feeds energy into the tank circuit and starts it on its oscillation cycle, as explained in last month's lesson. Coils L_t and L are purposely connected and arranged so that whenever the plate current flowing through L_t is *increasing*, the voltage it induces in L is of such polarity that it tends to drive the grid *more positive*. This is important! Consequently the voltage being induced in the tank coil by L_t not only serves to charge tank capacitor C but also drives the grid positive with respect to the cathode and thus further increases the plate current. This, in turn, further increases the voltage induced in L, the potential to which the tank condenser is charged, and the positive potential on the grid.

(3) Since these actions are cumulative, the plate current would build up indefinitely if it were not for two limiting actions that are automatically brought into play. First, due to the upper bend in the E_g—i_p characteristic of the tube, the plate current can increase only until the maximum or "saturation" value is reached. This is indicated by point *B* in Fig. 2. (In most power oscillators the circuit constants are made such that it is allowed to build up to this value so that maximum plate current will be attained).

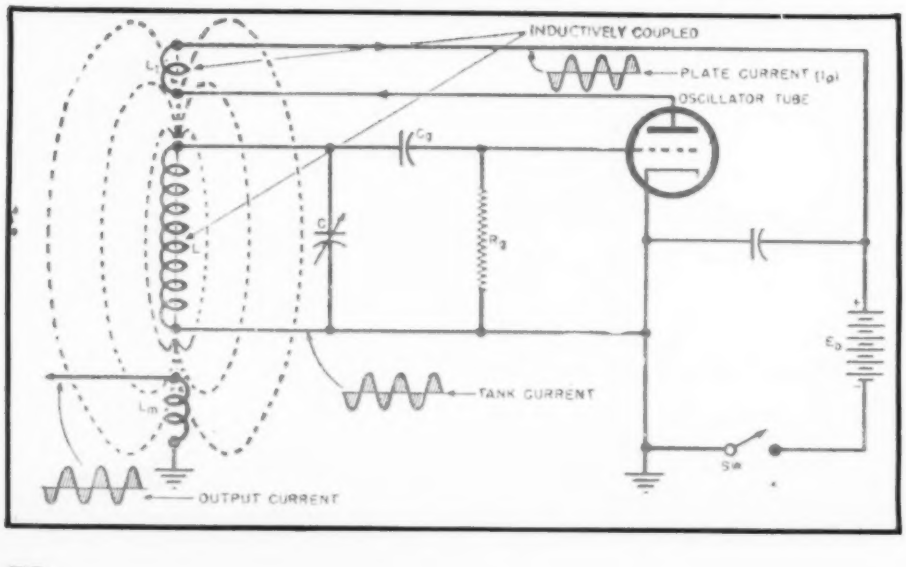
Secondly, as the grid becomes more and more positive it attracts an increasingly greater portion of the electrons in the stream emitted from the cathode. Due to the blocking action of the grid-blocking capacitor, C_g, these electrons have no escape path from the grid except by flowing into the grid side of C_g, or through the grid-leak resistor R_g. The direction of this electron flow through R_g is such that it tends to make the "grid" end of R_g become more negative (or less positive) with respect to the "cathode" end. Accordingly, during the period while the increasing tickler-induced voltage tends to drive the grid more *positive* (thereby increasing the plate current) the increasingly large number of *negative* electrons being attracted to the grid and trapped in the grid side of C_g cancel off an increasingly greater amount of this positive grid potential.

(4) When the plate current reaches its "saturation" value, point *B* in Fig. 2, it ceases to increase further, and the magnetic field around L_t therefore ceases to expand. When this happens, the magnetic field of L_t no longer induces voltage into tank coil L. Tank capacitor C, having been charged to its maximum potential in the meantime, now begins to discharge through the tank coil. Simultaneously, the positive potential of the grid begins to decrease due to the decrease in voltage that appears across capacitor C, and the fact that electrons being attracted by the grid and leaking off through the grid-leak resistor R_g cause negative bias voltage to be developed across it. As the grid potential falls, the plate current decreases, so the magnetic field around L_t collapses. The collapsing lines of force induce voltage (energy) into the tank coil in the opposite direction to that induced during the "charging" period. This induced voltage tends to drive the grid negative, so the process continues until the grid becomes sufficiently negative to reach the lower cut-off point, C, of the tube, at which point plate current ceases to flow.

(5) The tank capacitor having maximum charge again, now begins to discharge through the tank coil in the opposite direction (tending to make the grid less negative), and the plate current increases. This builds up the magnetic field around L_t thereby inducing in L a voltage of such polarity that it aids the foregoing action and tends to drive the grid posi-

(*Continued on page* 118)

Fig. 1. Basic grid-tuned oscillator circuit of the tickler-feedback type. The tube permits sustained oscillations to be produced.



TUBE SUBSTITUTION CHART

By RICHARD W. CRANE

Complete data for substituting those hard-to-get tubes. A total of 362 different tube types are listed along with necessary circuit changes.

SINCE certain tubes are extremely scarce today and hard to get even with high priorities, it is becoming increasingly difficult to keep equipment operating. It is possible in many cases, though, to substitute one tube for another and the accompanying chart lists substitutions for 362 types of tubes. Some of these require no wiring alterations but others necessitate changing the socket, rewiring the present socket, using a tube shield, and/or installing a filament shunt or series resistor. It is often simpler to use an adaptor rather than change or rewire a socket and these can be obtained ready-made for some substitutions, although they can easily be made from a tube base and a socket.

The tube manual should be consulted when making a replacement since some of the tubes listed only approximate the original, and may not give satisfactory results in critical circuits. Thus, a 45 could replace a 2A3 in a single ended amplifier, but should not be used in place of one 2A3 in a push-pull circuit. Moreover, these substitutions are not necessarily reversible; a 2A3, for example, could not replace a 45 in most circuits because it would draw appreciably more plate current and filament current. In r.f. and i.f. circuits slight realignment may be required if the substitute's interelectrode capacitances differ from those of the original.

In cases of dire necessity, rather peculiar replacements can sometimes be made; for instance, a 75 tube (6.3-volt heater) will give fair results in place of a 2A6 (2.5-volt heater), a 12A8GT has been used instead of a 6A8GT, and, in general, a tube having a higher heater voltage than the original can often be used, except in the case of rectifiers and power amplifiers. The cathode emission is far below normal when a tube is operated at a low heater voltage, of course, but since a voltage amplifier utilizes only a small portion of the normal cathode emission adequate performance can frequently be obtained. In series heater circuits even better results are possible since the drop in heater voltage is distributed over all the tubes. Substituting a 45Z5 for a 35Z5 for example would cause approximately an 8% drop in the voltage across each tube and little difference would be noticed in the operation of the circuit.

Some of the substitutions listed are not in line with the best engineering practice and theory; however, in the present world situation the important thing is to keep the equipment operating with available parts.

(ED.: For those who desire a more technical discussion on proper tube substitution or a procedure to follow in determining series or parallel filament resistors when substituting tubes, we would like to call attention to two articles published previously in RADIO NEWS: *"Servicing Hints on Tube Substitutions," July, 1944; and "Tube Substitutions for Radio Receivers," August, 1944.)*

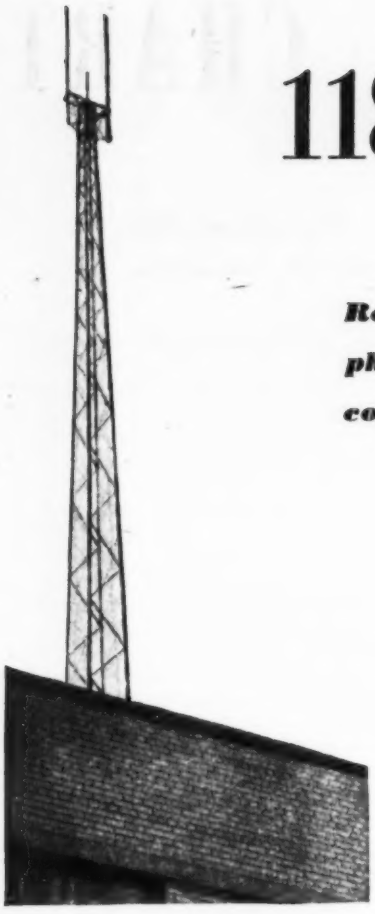
TUBE	SUBSTITUTES
0Z4	6X5[4]
1A4	1B4, 1D5[3], 34, 32
1A5	1LA4[3], 1LB4[3], 1T5
1A6	1D7[3], 1C6[6], 1C7G[6-3]
1A7	1B7[6], 1LC6[3]
1B4/951	34, 32, 1A4, 1D5[3], 1E5[3]
1B8/25S	1H6G[3]
1B7	1A7[2]—28 ohms, 1LC6[3-2]—28 ohms
1C5	1Q5, 1T5[2]—28 ohms
1C6	1C7G[3], 1A6[2]—33 ohms
1C7G	1C6[3], 1A6[3-2]—33 ohms
1D5	34[3], 1A4[3]
1D7	1A6[3], 1C7[6], 1C6[3-6]
1E4	1G4, 1LE3[3]
1E5	1B4[3], 32[3], 34[3]
1F4	1F5G[3], 950
1F5G	950[3], 1F4[3], 1G5G
1F6	1F7GV[3]
1F7GV	1F6[3]
1G4G	1E4, 1LE3[3]
1G5G	1F4[3], 1F5G, 950[3]
1H4	30[3]
1H5G	1LH4[3]
1H6G	1B5[3]
1I5G	950[3], 1F5G, 1F4[3]
1J6G	19[3]
1LA4	1A5[3], 1LB4
1LA6	1A7[3]
1LB4	1LA4, 1A5[3]
1LB6	1LC6[4], 1A7[3], 1LA6[4]
1LC5	1LN5, 1P5[3], 1N5[3], 1T4[3]
1LC6	1A7[3], 1B7[6-3], 1LB6[4]
1LD5	1SB6[3]
1LE3	1E4[3], 1G4[3]
1LH4	1H5[3]
1LN5	1LC5, 1P5[3], 1N5[3], 1SA6[3]
1N5G	1LN5[3], 1P5, 1E5, 1SA6[4]
1P5G	1D5GP, 1D5GT, 1N5, 1SA6[4]
1Q5G	1C5, 3Q5[4], 1T5[2]—28 ohms
1SA6GT	1N5[4], 1P5[4], 1LN5[3]
1SB6GT	1S5[3]
1T5GT	1A5[4], 1LA4[3]
1V	6Z3
2A3	45
2A5	47[3], RK17[3]
2W3	2Z2[3]
2X2	879[4], 2Y2[7-4]
2Y2	2X2[4], 879[4]
2Z2	2W3[3]
3B5GT	3Q5, 3C5, 3LF4[3]
3C5GT	3Q5, 1C5[6-4], 3B5, 3LF4[3]
3LE4	3C5[3], 3Q5[3], 3B5[3], 3LF4
3LF4	3C5[3], 3Q5[3], 3B5[3]
3Q4	3S4
3Q5GT	1Q5[6-4], 3C5, 3B5, 3LF4[3]
3S4	3Q4
5T4	5U4, 5X4[4], 83[3], 5Z3[3]
5U4G	5Z3[3], 5T4, 83[3], 5X4[4]
5V4G	83V[3]
5W4GT	80[3], 5Y3, 5Y4[4]
5X4G	5Z3[3], 83[3], 5T4[4], 5U4[4]
5Y3G	5Y4[4], 5Z4[4], 80[3]
5Y4G	5Y3[4], 5Z4[4], 80[3]
5Z3	5X4[3], 5U4[3], 83, 5T4[3]
5Z4	80[3], 5Y3[4], 5Y4[4]
6A3	6B4G[3], 6A5G[3]
6A4/LA	6G6[3-2]—42 ohms
6AB5/6N5	6U5/6G5[6], 6T5[6], 6E5[6]
6AB6	6AC6
6AC6	6AB6
6AC7/1852	1851[4]
6AD5	6F5[4], 6SF5[4]
6AD6	6AF6
6AE5	6AF5
6AF5	6P5, 6AE5
6AF6	6AD6
6AG6G	6M6
6A6	6N7[3], 6Y7[3], 79[3]
6A7	6A8[3], 6SA7[3], 7B8[3], 6D8[3-2]—42 ohms
6A8	6A7[3], 6SA7[4], 7B8[3], 6D8[2]—42 ohms
6B4G	6A3[3], 6A5G[4]
6B5	6N6[3]
6B6	6Q7, 6SQ7[4], 75[3]
6B7	7E7[3], 6B8[3]
6B8	6B7[3], 7E7[3]
6C5	6J5, 76[3], 7A4[3], 6L5[2]—42 ohms, 6P5
6C6	6J7[3], 6SJ7[3], 77, 6D7[3]
6C7	85AS[3]
6C8	6F8[6], 7N7[3-6], 6J6[3-6], 6SN7[4]
6D6	6K7[3], 6SG7[3], 6SK7[3], 78, 6U7[3], 6E7[3]
6D7	77[3-5], 6C6[3-5], 6J7[3], 6SJ7[3]
6D8G	6A7[6-3], 6A8[6], 6SA7[6-4], 7B8[6-3]
6E5	6T5, 6G5/6U5, 6H5
6E7	6D6[3-5], 6SG7[3], 6U7[3-5], 78[3-5]
6F5	6SF5[4], 7B4[3], 6K5[4]
6F6	42[3], 6K6, 6AD7[4], 41[3]
6F7	6P7G[3]
6F8G	7N7[3], 6SN7[4], 6C8, 6J6[3]
6G5	See 6U5/6G5
6H4	6H6[4-6], 7A6[3]
6H5	6U5/6G5, 6E5, 6T5
6H6	7A6[3-2]—42 ohms
6H8	7E7[3], 6B7[3]
6J5	6C5, 76[3], 7A4[3], 6L5[2]—42 ohms, 6P5
6J6	6SN7[3], 6F8[3], 6C8[3]
6J7	6SJ7[4], 6C6[3], 77[3]
6J8G	6K8[4], 6P8[4-6], 6E8[4], 7S7[3], 7J7[3]
6K5G	6F5[4], 7B4[3], 6SF5[4]
6K6G	41[3], 7B5[3], 42[3], 6F6
6K7	39/44[3], 6SK7[4], 6S7[2]—42 ohms, 6S6[4-6]
6K8	6P8[6], 6J8[4], 6E8[4], 7S7[3], 7J7[3]
6L5G	6P5[6], 6C5[6], 6J5[6], 7A4[3-6]
6L6	6V6
6M6G	6AG6
6M7	6T6[4-6], 6SE7[4]
6N5	See 6AB5/6N5
6N6G	6B5[3], 6AB6
6N7	6A6[3], 6Y7, 79[3]
6P5G	76[3], 37[3], 6AF5, 6AE7[4-6]
6P7G	6F7[3]
6P8G	6K8, 6E8[4], 7S7[3], 7J7[3]
6Q6G	6T7[4], 6Q7[4-6]
6Q7G	6SQ7[4], 75[3], 7B6[3], 6T7[2]—42 ohms, 7K7[3]
6R7	6SR7[4], 85AS[3], 85[3], 6V7, 6ST7[4-2]—42 ohms
6S6	7W7[3], 6SG7[4]

(Continued on page 103)

118-mc. FM Proves Successful

By W. G. McNULTY

Recent demonstration proves mobile two-way FM radiotelephone communications successful at 118 mc., opening new commercial possibilities in the very-high-frequency spectrum.



Dual antenna, 118 mc. left and 30-40 mc. right, mounted atop 150 foot steel tower at the Motorola plant.

BEFORE a group of eighty-five communications engineers, Don Noble, head Motorola research engineer, and Norman E. Wunderlich, Sales Manager of the Communications Division of the *Galvin Manufacturing Corporation* of Chicago, successfully demonstrated the use of the 118-megacycle spectrum for mobile two-way FM radiotelephone communications. One central control station, one remote control station, and three mobile units were employed.

Numerous theorists had said it couldn't be done; its range was limited to sight-to-sight distances; an object intervening would wash out the signals; and peculiar reflections and phase cancellations were openly predicted. But, 118-megacycle FM performed perfectly.

Closeup view of the transmitter and receiver with the monitoring unit in between. These units are installed in a patrol car for 118-mc. radiotelephone communications.

The 250-watt, FM 118.55-megacycle Motorola transmitter and receiver were located at the Galvin plant, 4545 W. Augusta Boulevard. The two-foot coaxial antenna was located at the top of a nearby 150-foot steel tower. A deluxe, remote control console was installed in the ballroom of the Graemere Hotel on Chicago's West side, about two miles from the factory and sufficient monitor speakers were provided in order that those present could hear both sides of the communications.

The three mobile units traveled on the North, South, and West sides of Chicago, and one test car was dispatched into and throughout the Loop District. The power of the mobile unit was ten watts and the conventional roof-top type of antenna was used. For the 118-megacycle frequency, antennas only twenty-three inches in length were required as against the usual six-foot antenna required for the 30 to 40 megacycle band.

At all times and in all locations, the signal was solid both ways. Even under a two-level roadway of heavy reinforced steel and concrete, reception was excellent and talk-back clear and distinct. The same was true on the South and West sides and, on the North side, one test car traveled thirty miles north of the central station, and yet maintained perfect contact all the way. The test cars operated for two hours and at no time did any car's talk-back fail to wash out all background noise.

Complete logs of signal strength were recorded for station-to-car, car-to-station and car-to-car. These records revealed that there is little doubt about the feasibility of using the 118-megacycle band for two-way radiotelephone communication systems within a radius of 20 miles from the central control station. Beyond 25 to 30 miles, the talk-back from a ten-watt mobile transmitter washes out completely and car-to-car talk is limited to less than five miles. The record also indicates that with power of 250 watts for the central station transmitter and with the coaxial antenna 150 feet above ground level, mobile reception is perfect up to 35

Three test cars demonstrate 118-mc. FM three-way system. Meter being held indicates signal strength from 250-watt station.

Engineers obtain receiver field-strength reading on the car signals from engineer stationed at the remote receiving end.

miles, but probably washes out completely at 40 to 50 miles.

The central station and mobile transmitters used at Chicago have a power output of about 20 watts, FM. The receivers are triple conversion, crystal controlled, FM superheterodynes with a sensitivity of about one-tenth of one microvolt. No spark suppressors or any other noise reduction accessories were used on any of the test cars.

A comparative test was also made of the 118-megacycle performance to that of the 30 to 40 megacycle band. In both cases, the 30 to 40 megacycle band was a poor second. Electrical interference common to the lower frequency was not encountered at the higher level. Mobile reception in the 30 to 40 bracket was impossible in the same locations where the 118-megacycle frequency came through clearly and distinctly. In other cases, two-way communications at the lower frequency were most unsatisfactory, while the 118-megacycle frequency gave perfect two-way performance under the same conditions and with the same electrical disturbances. Diathermy interference was not encountered at the higher frequency although it was a common occurrence on the 30 to 40 megacycle band.

During the past several years other experiments with the 118-megacycle band were, and now are being conducted. As a result of these and other experiments conducted over this period of four years, the following findings and conclusions are indicated.

The performance of the 118-megacycle band is definitely superior to the performance obtained on the 30- to 40-megacycle spectrum.

Electrical interferences, common to the 30 to 40 band are entirely eliminated on the 118-megacycle band.

So far as is yet known, there is no skip to the 118-megacycle band.

The 118.55-megacycle wavelength has a definite penetration through most materials which is greatly superior to the penetration characteristics of the 30 to 40 band.

Reception at 118.55-mc. is *not* limited to sight-to-sight distances.

Intervening objects do not cause the 118.55-megacycle frequency to be washed out.

Phase cancellations are not indicated and have not occurred on any of the tests conducted to date.

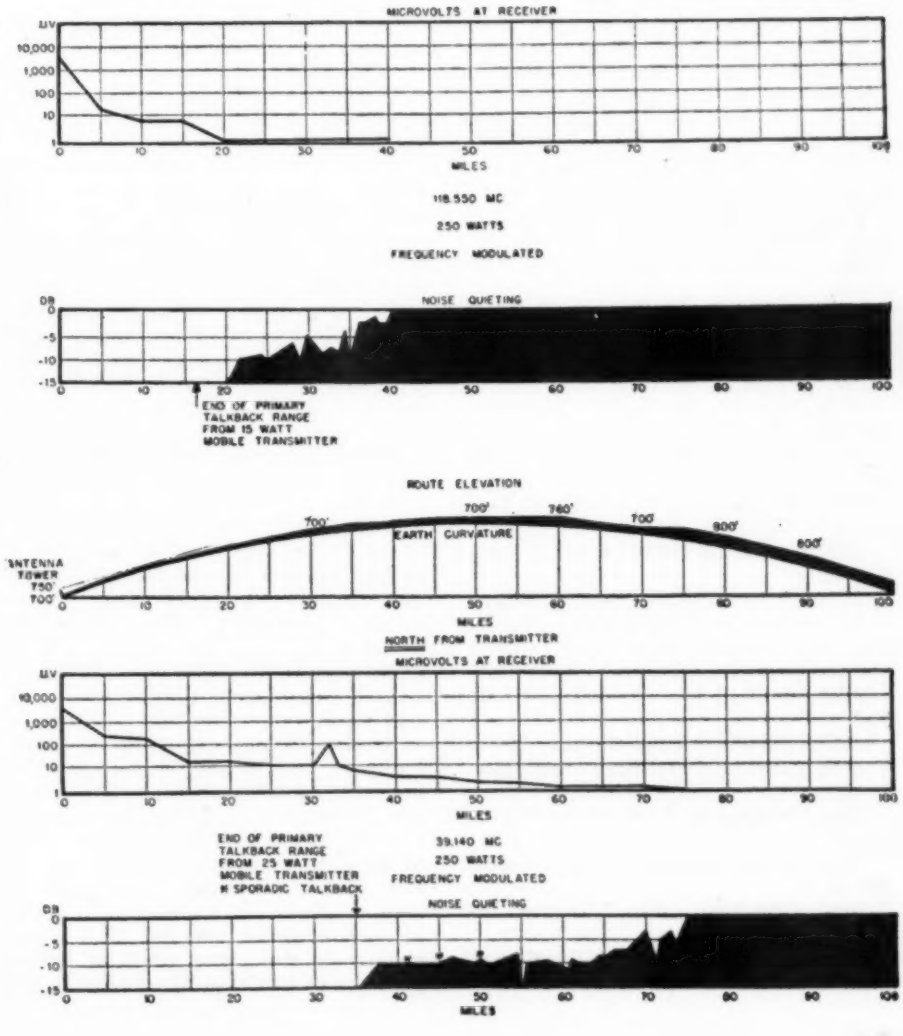
No peculiar reflections have been noted so far.

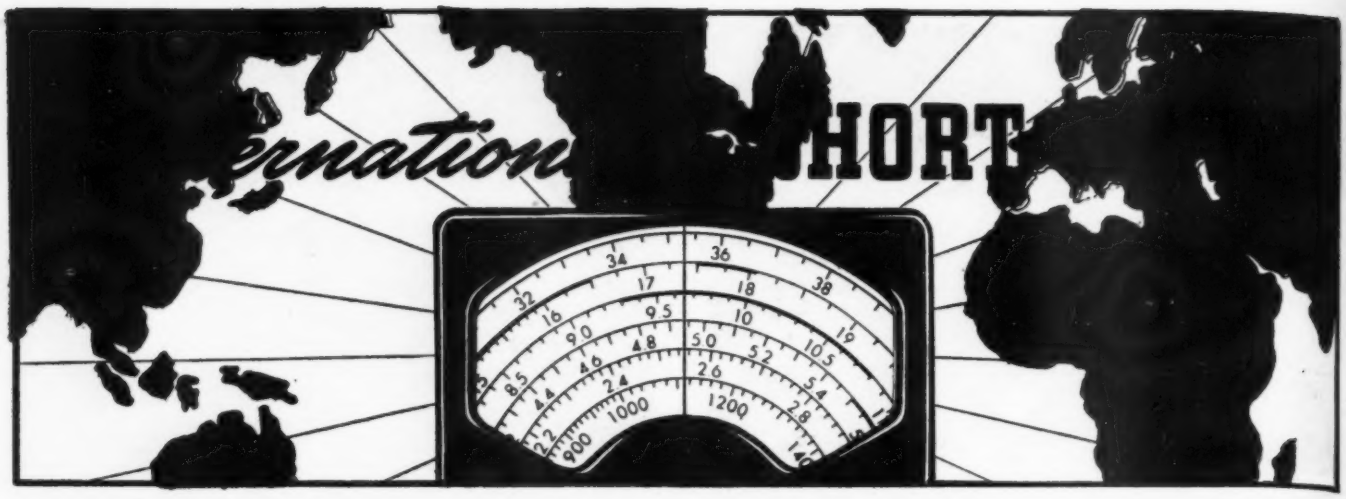
The range of the 118.55-megacycle frequency is definitely limited and may be successfully controlled only up to a range of 30 to 40 miles, at which distance the signals fade out completely.

There are no operational nor equipment difficulties attached to the use of the 118-megacycle band; on the contrary, this wavelength permits the use of antennas less than two-feet

(*Continued on page* 151)

Chart shows records of comparative tests made on 118.55 mc. and on 30-40 mc. in Chicago, with station power of 250 watts; mobile units of 15 watts for 118.55 mc. and 25 watts for 30-40 mc. Reception and talkback range are indicated in miles.





Compiled by **KENNETH R. BOORD**

FROM Christchurch, New Zealand, Colin L. Sutton, veteran listening-post operator in the South Pacific writes that "all short-wave stations are being received here at present (December) with great strength. Some of the best are WBOS, R-7; WRCA, R-8; WLWO, R-7; DJD (Berlin), R-9, so you can see that everything is to a DX'ers liking."

Mr. Sutton advises that ZLT7, Wellington, with 5 kilowatts power, on 6.715 megacycles, is the only short-wave station in New Zealand. It operates 8:45-10 p.m., New Zealand Summer Time.

He sent along a list of broadcast stations in New Zealand, some of which may be heard in the U. S. and which are tried for by both SW and BCB fans. The list follows:

2YA, Wellington, 570 kilocycles, 6 a.m.-11:15 p.m., 60 kw.

LYA, Auckland, 650, 6 a.m.-11:15 p.m., 10 kw.

4YZ, Invercargill, 680, 7 a.m.-10 p.m., 4 kw.

3YA, Christchurch, 720, 6 a.m.-11:15 p.m., 10 kw.

2YH, Napier, 750, 7 a.m.-10 p.m., 5 kw.

4YA, Dunedin, 790, 6 a.m.-11:15 p.m., 10 kw.

2YB, New Plymouth, 810, 6 p.m.-10 p.m., 100 w.

2YC, Wellington, 840, 6-10:30 p.m., 5 kw.

1YX, Auckland, 880, 6-10:30 p.m., 150 w.

2YN, Nelson, 920, 5-10 p.m., 400 w.

3ZR, Greymouth, 940, 7-11:30 a.m., 12-5 and 6-10 p.m., 75 w.

2ZJ, Gisborne, 980, 6-10 p.m., 100 w.

2YD, Wellington, 990, 6-10:30 p.m., 250 w.

4ZD, Dunedin, 1010, 6-10 p.m., 100 w.

1ZB, Auckland, 1070, 6 a.m.-12 p.m., 1 kw.

2ZB, Wellington, 1130, 6 a.m.-12 p.m., 1 kw.

4YO, Dunedin, 1140, 6-11:30 p.m., 150 w.

2ZM, Gisborne, 1180, 7-10 p.m., 100 w.

3YL, Christchurch, 1200, 6-10:30 p.m., 175 w.

1ZM, Auckland, 1250, 5-11 p.m., 1 kw.

4ZB, Dunedin, 1310, 6 a.m.-12 p.m., 1 kw.

2ZA, Palmerston, NTH, 1400, 5-10 p.m., 250 w.

3ZB, Christchurch, 1430, 6 a.m.-12 p.m., 1 kw.

Incidentally, Mr. Sutton is a member of the Universal Radio DX Club, America; the New Zealand DX Club; All-World All-Wave Club, Australia; New Zealand Radio Hobbies Club. He was winner of the World-Wide DX Contest, 1935-1936.

* * *

DOMINICAN REPUBLIC

From M. E. Nanita, Director General de Comunicaciones of the Republica Dominicana, we learn that the following stations in the Dominican Republic are now in use:

HIX, HI1X and HI3X, transmitting on 950 kilocycles, 315.8 meters; 6350 kilocycles, 47.24 meters; and 11850 kilocycles, 25.32 meters. They are located in Ciudad Trujillo, capital of the Dominican Republic. Regular schedule is 6:45-8:30 a.m., 12-2 p.m., 6:30-10:15 p.m. The last transmission on Sunday afternoon is to 2:30 p.m. All transmissions are in Spanish, according to Senor Nanita.

* * *

INTERNATIONAL REPLY COUPONS

Those desiring to secure verification from foreign short-wave stations will have much better success, I believe, if they will enclose an international reply coupon with each reception report. Having had several inquiries concerning these, I quote the following from a letter just received from Smith W. Purdum, Second Assistant Postmaster General, Post Office Department, on this subject:

"International reply coupons (which cost nine cents in this Service) are accepted by all foreign countries, with the exception of Italy, the Vatican City State, and Nicaragua. . . . Due to conditions brought about by the war, this Department has been unable to maintain an adequate supply of such coupons, and for that reason it is understood the stock at certain post offices has been depleted. A new supply of international reply coupons has recently been received, and no further difficulty should be encountered in the purchase of same. It may be suggested, however, that if the stock has not been replenished at your local post office, your needs may be met at other post offices in your locality."

Of course, such coupons are good only in Allied or neutral countries at this time. A "reply coupon" may be purchased (price 9 cents) at post offices, which, upon presentation at a post office in any of the countries of the Universal Postal Union, except those listed above, will entitle the person presenting the coupon to receive (without charge) a postage stamp or postage stamps of that country of sufficient value to prepay an ordinary letter of the first unit of weight from the country of origin of the letter addressed for delivery in this country. By this arrangement a person in the United States can furnish his correspondent abroad with a postage stamp with which to prepay postage on a reply to his letter. The period of exchange is not restricted.

* * *

NEW

The new International Service short-wave broadcasts of the Canadian Broadcasting Corporation are being experimentally transmitted over station CHTA on 15.22 megacycles (19.67 meters); the transmissions started Christmas.

Stuart W. Griffiths, public relations representative of Canada's International Service, informs me that "we plan to use our second 50-kw. transmitter in the near future and upon the completion of our antenna system, we will be operating on eleven frequencies." (These should be in operation by this time.) The eleven frequencies and calls are listed as follows:

CKOB, 6.09; CKLO, 9.63; CKXA, 11.705; CKCX, 15.19; CKNC, 17.82; CHAC, 6.16; CHLS, 9.61; CHMD, 9.64; CHOL, 11.72; CHTA, 15.22; and CHLA, 21.71.

Those desiring printed schedules as soon as they are available, should contact Mr. Griffiths at P. O. Box 189,

Station H, Montreal, Quebec, Canada.

* * *

CHANGES

The correct schedule of KRHO, Honolulu, Hawaii, on 17.80, is 7 p.m.-2:45 a.m.; and on 6.12, 3-11:15 a.m. EWT. These transmitters are beamed to Japan, Korea, Manchukuo, China, and Formosa. Very strong signal, but at present, 17.80 is fading out some nights by 11 p.m., heard to 1 a.m. others. (Balbi, California.)

VLC5, Australia, 9.54, has replaced VLC6, 9.615, to the East Coast of North America, 8-8:45 a.m.

Manchukuo, 15.33, 1-2:30 a.m., not audible now; on 6.125, 5-9:20 a.m. in Home Service, and again on 5.71 and 6.125, 9:30-11 a.m., bad QRM from KRHO on 6.125 frequency, clear on 5.71 almost any day. Balbi, Calif.)

PIRN, 9.64 and 6.14, Japanese-controlled Manila transmitters in the Philippines, went off the air February 3 or 4. "Did not hear them early Sunday nor afternoon, February 4." (Balbi.)

CFVP, 6.03, Calgary, Canada, has increased its power considerably. Schedule is now 5:30 a.m.-11 p.m.; has BBC news relay at 12 noon. (Balbi.)

XGOA, Chungking, 5.92, in parallel with 6.14, now heard 9:55-10:15 a.m. only; English news, 10 a.m. (Balbi.)

WLVC, 7.795, Leyte, Philippine Islands, relays the "Voice of Freedom" from General McArthur's Headquarters on Luzon every hour for fifteen minutes with war news in English—starting at 4 a.m., last 8-8:15 a.m.; good signal daily. (Balbi.)

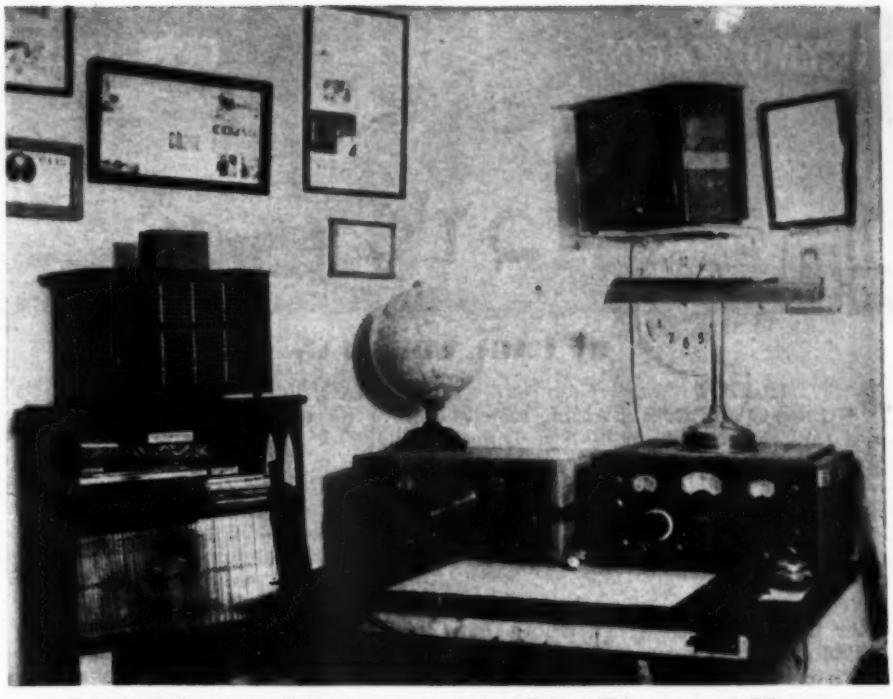
VUD, 7.30, Delhi, India, scheduled 8-10:30 a.m., off since February 1. (Balbi.)

Relay of PIRN, Japanese-controlled Manila station, by "Radio Shonan" (Singapore), 15.44, not heard since February 3. (Balbi.)

XGOY, Chungking, 6.14, moved from 6.135; strong signal daily now.

Lourenco Marques, Mozambique, heard on 9.710, with news in Portuguese, 3:40-3:50 p.m.; news in English from the British Press, 3:51-3:56 p.m.; music, 3:56-4:25 p.m. with sign-off at 4:31 p.m. Another day was heard signing at 2:25 p.m. with music; very strong signals. (Harris, Mass.)

Overseas short-wave broadcasts from Australia's ABC went on a new schedule operative January 17. Melbourne frequencies now in use are VLG, 9.58; VLG2, 9.54; VLG3, 11.71; VLG4, 11.84; VLG6, 15.23. Shepparton, Victoria (near Melbourne) frequencies in use are VLC2, 9.68; VLC4, 15.315; VLC5, 9.54; VLC6, 9.615; VLC7, 11.84. Transmissions beamed to North America follow: 8-8:45 a.m., VLC6; 11-11:45 a.m., VLG3 and VLC6; 9:45-10:45 p.m., VLG3 and VLC4; 1:10-1:45 a.m., VLG3 and VLC7. Other English broadcasts include 8-8:15 p.m., VLC4, on loan to U.S. O.W.I. for broadcast to the Philippines; 11-11:25 p.m., to forces in Northern Australia, VLG6 and VLC4; 2:55-3:25 a.m., to Britain, VLG3; 5-6 a.m., VLC6, on loan to U.S. O.W.I. for broadcast to the Philippines; 5:30-6:15 a.m., to forces in Southwest Pacific, VLG4; 10-10:15 a.m., to Asia, VLC6; 10:35-10:45 a.m., to forces in India, VLG and VLC6; and 12:15-12:45 p.m., to Britain, VLC2. Some English is used on the 6:15-7:45 a.m. transmission to Asia over VLG4 and VLC6; on the 8-9 a.m. transmission to Asia over VLG2; and the 9-10 a.m. transmission to Asia over VLG2 and VLC6. VLC4, 15.315, is again being heard well on the East Coast, 9:45-10:45 p.m.



A typical short-wave listening post is that of Robert Holermann, of Alliance, Ohio. With his SX-32 he uses a horizontal and vertical antenna; with his SX-17 he employs a 98-inch vertical antenna. He is quite an authority on DKSA ("Radio Atlantik"), having been a regular listener for more than a year now.

The ABC informs me that in addition to the above ABC transmitters, there are other domestic short-wave stations transmitting from Australia. These are also heard well in the United States, particularly VLW6, in the 31-meter band mornings, with the National Australian Program. A list of these stations is expected to be available shortly from the Australian News and Information Bureau, 610 Fifth Avenue, New York City.

* * *

BEST BETS FOR BEGINNERS

WASHINGTON—Best bests for the state of Washington are listed as follows by Dwight Hanson, Tacoma, Washington (PWT):

VLC5, 9.54, Shepparton, Australia, program for the western states of North America, 8-8:45 a.m., news in English, 8 and 8:35 a.m.; excellent.

VLC2, 9.68, Shepparton, Australia, program for North America, 9-9:45 a.m.; news at 9 and 9:35 a.m.; good.

Australia, 15.16, 1:45-3:15 p.m., news at 2:45 p.m.; fair.

VLC4, 15.315, Shepparton, Australia, program for North America, 6:45-7:45 p.m., news at 6:45 and 7:30 p.m.; fair.

VUD-2, 6.19, New Delhi, India, program for North America, 7:50-9 a.m.; news in English, 7:50 and 8 a.m.; good. As "Armed Forces, New Delhi," broadcasts 5:50-7 p.m.; news at 6 p.m.; relays BBC newscasts at 8 a.m. and 6 p.m.; excellent.

New Delhi on 6.15, 7-9 a.m.; news in English, 8 a.m.; excellent.

FZI, 11.97, Brazzaville, French Equatorial Africa, 11 a.m.-5:45 p.m.; news in English, 11:45 a.m., 1:45, and 4:25 p.m.; good to excellent.

RNB, 9.783, Leopoldville, Belgian Congo, heard from midmorning until it signs off at 9:45 p.m.; for North America, 5:15-6:15 p.m.; relays BBC to North America, 6:30-9:45 p.m.; good to excellent.

GVZ, 9.64, GRH, 9.825, GSU, 7.26, and GSL, 6.11, London, heard in North American Service, 2:15-9:45 p.m.; the 9.64 frequency shuts down at 4.45 p.m.; the 6.11 frequency is best one heard in the evening; English news, 2:45, 3:45, 6, 7:45, 9:30 p.m.; fair to good.

GSI, 15.26, London, African Service, 8:30 a.m.-2 p.m.; fades out after 12 noon; English news, 9, 11 a.m.; 1:45 p.m.; good.

GSB, 9.51, GVW, 11.70, GSD, 11.75, GSE, 11.86, London, General Forces Program, from approximately 8 a.m. to 2 p.m.; English news, 8, 10 a.m.; good.

DXJ, 7.24, Berlin, and on 6.19, heard in North American Service, 2:50-10:15 p.m.; news in English on the hour every hour; poor to good.

Berlin on 9.675, African beam, with DJL, 15.11, heard 8:40 a.m.-2:30 p.m., with news in English at 8:45 a.m.; fair to good.

JZI, 9.535, Tokyo, JVW3, 11.725, JVW, 7.257, and JLT, 6.19, heard to western states of North America, 8

(*Continued on page* 94)

By CARL COLEMAN

J. N. ELLIOTT has taken out a Liberty and Robert Alving sailed on a tanker for a change. Eric Dunlop was in again aboard his craft on the regular schedule, as was H. Harris. L. R. Balton has taken a 2nd opr berth out of the East Coast. R. Orr is out as chief on a small cargo vessel, as is F. Kirste.

We have received a very interesting letter from Kenneth Green who went to Duluth, Minnesota, to take a new ship from the Walter Butler shipyards down the Great Lakes and St. Lawrence River to New Orleans. Ken sends along the following regarding the boys from up on the Lakes and where they hole up during the long winter months: "There are still quite a few c.w. operators left on the Lakes, mostly on passenger ships where operators are required by law but radiotelephone has displaced many good jobs for such operators.

"The Detroit & Cleveland Navigation Company has five passenger ships which are thus equipped. Recently their two best jobs, the overnight boats City of Cleveland 3rd and City of Detroit 3rd gave way to radiotelephone, and Brother Joe Spychalski who has been the radio operator on the 'C2' for many years as well as Brother Ernest Baccari the radio-operator on the 'D2' had to find themselves another home, which they did by bumping the Chief Operator on the 'Greater Detroit' and Eastern States, on the Detroit-Buffalo overnight run.

"Most of these operators are oldtimers, who come back to these jobs each spring when the Lakes open, and work in defense plants during the winter months but this season after the boats laid up for the winter, we all decided to ship out on the outside.

"Brothers Tom O'Malley, 'Scotty' Gould, Joe Spychalski, Ernest Baccari, and Fred Gritzner shipped out of New York as chief operators aboard Liberty Ships. Henry Gantt, chief operator of a former passenger wagon is now broadcasting for the winter at WMAQ. Henry 'Coal Collier Smitty' Smith as usual grabbed a coastwise collier for the winter—quite a letdown from his former cruise ship."

D. M. Gallant has gone out from the East Coast aboard a tanker. K. H. Hanson has taken out a small cargo craft for a change. K. Knudsen is also out on a small freighter, from the Atlantic coast, as chief operator.

We also received a letter from William J. Schruba who is a radio operator with the AACS. W. J. wants to get into marine radio after the war.

In late January it was reported from the West Coast that Pacific Coast shipyards had built nearly two thousand ships in three years of war, a volume in tonnage which exceeded the total prewar U. S. merchant fleet.

RECENT information made public from Washington will apparently set the United States up with a postwar standing Army and Navy of about one million men. This would be the largest in the history of our country. It would consist roughly of an Army numbering between half a million to 600,000 officers and men and a Navy of about 450,000 men. The Navy has already released its 1945 program calling for the expenditure of about 28 or 30 billion dollars. Five or six billion will be used for military pay and the remainder for the construction of ships and planes and for ordnance, supply, and shore equipment. The Navy also announced that H. S. Hensel has been nominated by President Roosevelt as new Ass't Secretary.

"Is that absolutely necessary —just to solder a wire?"

ADMIRAL EMORY S. LAND, head of the U. S. Maritime Commission has proposed a postwar merchant fleet of at least one thousand vessels to be held by law in a snug harbor tieup. Most of this fleet would be Liberty models and would be a reserve of approximately ten to twenty million tons of shipping. Land reported that this would be "insurance to prevent another war, a war which more than ever would be one of transportation."

Under Admiral Land's plan the 1000 ships would cost approximately three thousand dollars per year to maintain by sealing the machinery and using modern antibarnacle methods for hull protection. The proposal was in connection with the Independent Offices Supply bill, which was reported to the House in early February.

It was also urged that Germany and Japan, after the war, be permitted only coastwise shipping, China to be encouraged to start the construction of a real merchant marine and the U. S. to increase by 50 to 100 percent its 1939 ocean shipping. It was also proposed that the U. S. construct from six to ten passenger liners of the commercial type rather than of the "super" type, to engage in the European, South American, Chinese, etc., trade. It was also proposed that about twelve million tons would be sold to allied nations after the war.

The proposed tieup fleet, which would be kept in condition, was suggested by Admiral Land to prevent a glut of postwar shipping which would be the case if the U. S. tonnage on hand at the end of the war beyond what can be used by this country were to be turned loose at "bargain" prices to foreign shipping outfits. This would ruin U. S. merchant fleet chances, which to us means jobs for U. S. radio officers.

IT WAS announced in mid-January by W. W. Schwenk, Atlantic Coast Director, War Shipping Administration, that all previous records for shipments from Atlantic Coast ports were broken during 1944 when over 25 million tons of dry and 12¾ million tons of bulk liquid cargo were moved out of the East Coast. Dry cargo alone increased seventy percent over the previous year. Sailings were up from 3148 in 1943 to 4868 in 1944. Mr. Schwenk reported that the East Coast shipped nearly half of the dry cargo carried out of the country. The increase was due in part to the 20 percent greater number of vessels on hand, as well as greater efficiency in loading, unloading, servicing, etc.

Mr. Schwenk declared that this achievement would not have been possible without the cooperation of the maritime and stevedore unions, ship-line operators, railroads lighter-

(*Continued on page* 104)

THEORY AND APPLICATION OF U.H.F.

By MILTON S. KIVER

Part 10. An explanation of the importance of the electric field theory of Maxwell's equations in describing u.h.f. phenomena. A subsequent article will cover a similar explanation based upon the magnetic principles.

THE name of Maxwell seems to be ever present in describing ultra-high-frequency phenomena and this perhaps, is as it should be, since without his work it might have taken a great deal longer to fill out the ideas on wave propagation.

The set of equations that form the basis for the electromagnetic theory are called Maxwell's equations, although he is not solely responsible for most of them. All these equations are expressed either in ordinary differential form or compactly placed by means of vector analysis. Neither will be used here since it is the avowed purpose of these article to use very little mathematics, so (with apologies to Maxwell) an attempt will be made to discuss these important relations without the benefit of the exact science. With this explanation as a background it should be much easier to comprehend some of the properties of wave guides, cavity resonators, antennas, and any other device that depends for its action on the above-mentioned law.

Maxwell's equations are generalized statements on the behavior of electric and magnetic fields. The electric laws are based on the observed behavior of the electron and the influence it exerts on other nearby electrons. It would have been just as easy to have based all our findings on the proton (positive charge) behavior, but since the electron is the more mobile of the two it is easier to deal with its properties. For the magnetic laws it is necessary to go back to the properties of a magnet and see its actions and reactions when brought near other substances that are affected by it. When all these important facts are tabulated, there are four (sometimes given as five) statements that form the starting point. These four (or five) equations are known as Maxwell's equations.

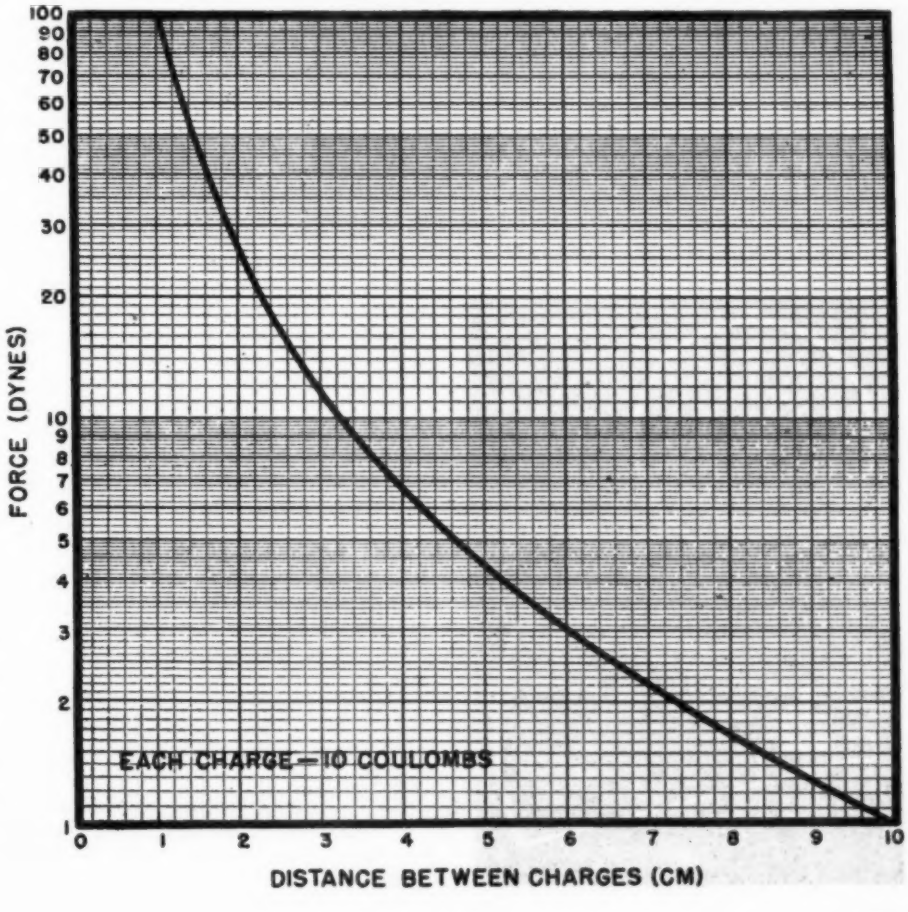
Now to see just what these equations mean. They set down a set of rules by which the science of electromagnetics has been developed. As long as these rules are followed, all is fair; but if any deviations are introduced, then the fundamental principles of the science are being ignored and something else is now being engaged in; another game—so to speak. There is nothing wrong in modifying the rules if it is found that experience dictates such a change. But so far Maxwell's equations have predicted all the observed results so it is safe to assume that they are entirely correct and no attempt should be made to change any of their forms.

These equations may be looked upon as four walls to keep the players within certain confines. While in these boundaries they may make other limitations, such as having the electric or magnetic fields restricted to one direction, but this is still within the game since the general rules are in no way being altered. The rules are just not being used to their fullest extent—that is all. Since the equations work in one, two, or three dimensions, it is possible to use the above restrictions and still arrive at correct results.

Fundamental Electrical Theory

Before any discussion of the above equations will be undertaken, it would be advisable to review the foundations of all electric and magnetic theory. The electric field will be dealt with first. Any electric charge, such as an electron, exerts a force upon other charges near itself. This force, while being just as much a force as the gravitational pull or the force exerted by a machine, does not apply to every material body in the universe but only to other electric charges. If these other charges are positive, the force is one of attraction while if they are negative, it is a repelling force. Now, for many people the idea of just showing a charge without indicating its force was rather hard to understand, so whenever an electric charge is shown, lines radiating away from this charge are also drawn and these lines are called lines of force. They are the pictorial representations of what cannot be seen but what is quite definitely there, namely, the force itself. Fig. 5 shows these

Fig. 1. Showing the relationship of force vs. distance between electrical charges.



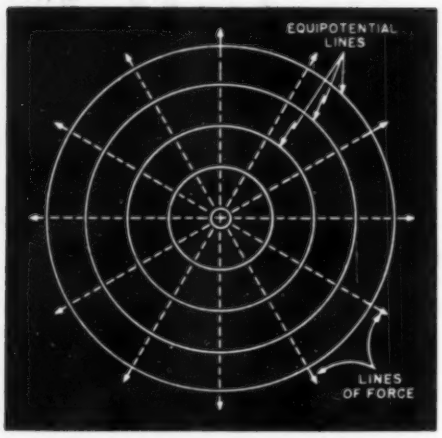


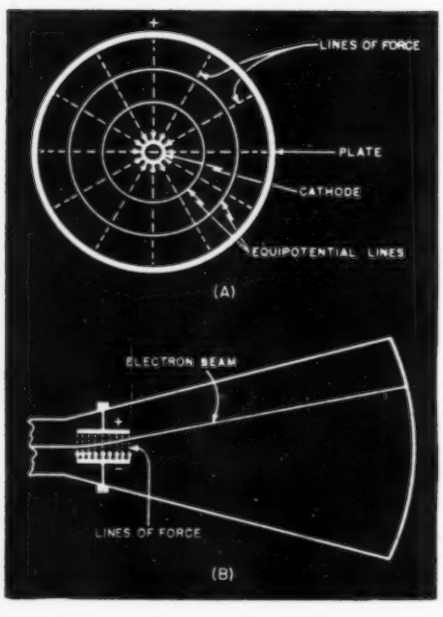
Fig. 2. Indicating the distribution of force about an electric charge by means of equipotential lines.

various lines, both for attraction and repulsion.

In addition to the representation of the electric lines of force, as in the above figure, it is also possible to indicate the distribution of electric forces as in Fig. 2. Here, instead of lines of force, we have all the points that have the same force exerted on them, connected by one line. Because of the symmetry of the field about the electric charge, these equipotential lines happen to be concentric circles. However, this is a special case and will not always occur. The circles closest to the center have the greatest force exerted on them, while the farther away we get from the central electric charge, the less the force.

Note that the equipotential lines never cross each other. If one were to place an electric charge on an equipotential surface or line, then it would require no work at all to move this charge along this equipotential line because the charge is neither being moved toward or away from the central electrical charge. Radio engineers, especially those engaged in

Fig. 3. The use of lines of force and equipotential lines in radio tubes.



tube manufacture, use charts illustrating the equipotential lines and fields of force within tubes quite extensively. To illustrate, refer to the diagrams of Fig. 3.

In Fig. 3A, we see that in a simple diode having a cylindrical plate, the lines of force are radial from the plate to the cathode. The equipotential lines are also drawn and an electron leaving the cathode will try to reach the plate by the shortest route. The shortest route will be along the path where the force that is exerted by the plate is greatest. This will always occur along the lines of force or at right angles to the equipotential lines. Hence, the electron will travel in a straight line from cathode to plate.

In Fig. 3B we have the deflecting plates of a cathode-ray or television tube. The electron beam, in speeding toward the fluorescent screen, must pass between these plates and while in this region, will be subjected to the electric field that exists there. The plate that is more positive will attract the negative electron beam and cause the beam to deflect in this direction. The stronger the voltage, the greater the deflection.

Here we have merely two examples of the use of visualizing electric forces and electric fields and how they are utilized, whether directly or indirectly, in radio apparatus.

The regions that the electric forces act in are called electric fields and, in the literature of the subject, are quite often referred to. These electric fields can be explored by taking other electric charges and placing them under the influence of these fields of force. From the way these outside charges act it is possible to tell the direction of the force in these fields and just how intense the field strength is. By experimenting with electric fields of various strengths and noting different reactions on charges placed in these regions, it is possible to arrive at rules which govern the behavior of all such situations. Thus the first step, experimentation, will lead on to the next point where it is possible to express all the facts in a law or formula and which will cover all data taken under similar conditions. For the case just mentioned there is Coulomb's Law which states that the force acting between two electric charges (or what is the same thing, two electric fields, since fields are produced by charges) is directly proportional to their strengths and inversely proportional to the square of the distance between them. Using the formula notation, it is

$$F = \frac{q_1 \, q_2}{d^2}$$

where

q_1 is the amount of charge of one unit

q_2 is the amount of charge of the other unit

d is the distance between them

F is the force brought on by placing the two charges close to each other.

Before going much further it might be advisable to point out that while the terms electric field and electric intensity are sometimes used interchangeably, they are really separate. The electric field refers to the region or place where the electric intensity or electric force acts and is not actually attached or connected to this force in any way. It is quite analogous to a pitcher or container of water and the water itself. Both are distinct and yet when placed on the dinner table the two terms are used interchangeably. In the same sense, electric field, electric field intensity and just plain electric intensity may be considered one and the same as far as it will be used here.

Laws for Electric Fields

The next phase that interested the scientists after they had formulated

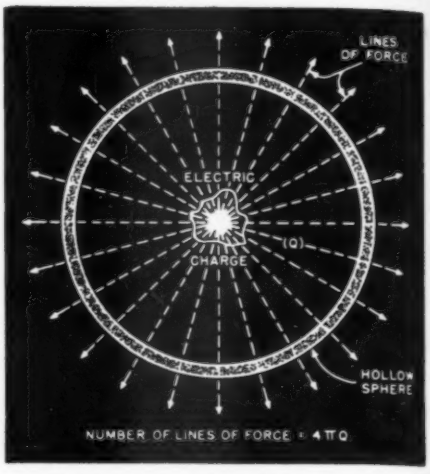


Fig. 4. The number of lines of force leaving any electrical charge is (by definition) equal to $4\pi \times$ the charge.

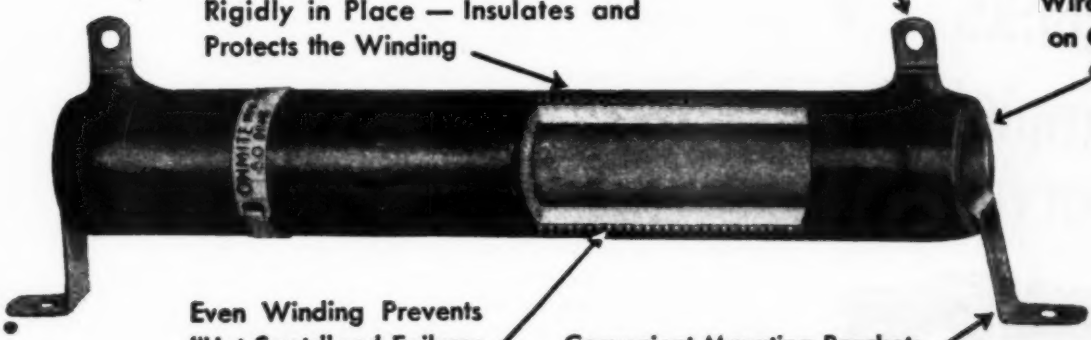
the ideas of electric charge and electric force or intensity was to get the exact relationship between the charge and the amount of electric field intensity due to this charge. The problem was this: Suppose there was some charge inside a hollow sphere. How is the number of lines of force or how is the electric intensity related to this charge Q? The answer is known as Gauss' Law and in words it states that the net outward electric flux (or lines of force) from any charge in all directions is 4π times the amount of charge Q. See Fig. 4. Thus there are two fundamental relationships that hold in a region containing electric charge:

1. First is Coulomb's Law and this sets up the idea of electric charges and the forces between them.

2. And second is Gauss' Law which gives the exact relationship between the force set up by any charge and the amount of the charge itself.

It is to be noted that whenever lines of force are drawn they are always shown with arrows (Figs. 2 and 5). These arrows are meant to indicate the direction in which the electric force due to the charge act. The electric theory was first developed by men who postulated that the lines of force

Why OHMITE Resistors PERFORM SO DEPENDABLY


Tin-Dipped Copper Terminal Lugs
Special Vitreous Enamel Holds Wire Rigidly in Place — Insulates and Protects the Winding
Resistance Wire Wound on Ceramic Core
Even Winding Prevents "Hot Spots" and Failures
Convenient Mounting Brackets

Here you see a few of the important features that insure long life and trouble-free service in every Ohmite Resistor. In the lug type illustrated above, the resistance wire is both mechanically locked and brazed to copper terminal lugs to assure perfect electrical connection. Time-proved Ohmite vitreous enamel construction dissipates heat rapidly . . . withstands humidity. Today, Ohmite Resistors are extensively used in the Armed Forces, Industry, Communications, Research. *Made in a wide range of types and sizes* in stock and special units for every need. Consult Ohmite engineers on your resistor problem.

OHMITE MANUFACTURING COMPANY
4883 FLOURNOY ST., CHICAGO 44, U. S. A.

Send for Handy Ohm's Law Calculator

Helps you figure ohms, watts, volts, amperes—quickly. Solves any Ohm's Law Problem with one setting of slide. Send only 10c in coin for handling and mailing.

Be Right with OHMITE
RHEOSTATS • RESISTORS • TAP SWITCHES

One Central Source
for Everything in
RADIO and ELECTRONICS

Largest Stocks

Complete Service

FREE! *Complete Helpful* BUYING GUIDE

Vital supplies speed from Allied to every corner of the nation. At this central source are concentrated today's largest and most complete stocks under one roof . . . tubes, parts, kits, test equipment, public address . . over 10,000 items from all leading manufacturers . . . for training, research, engineering, production and maintenance.

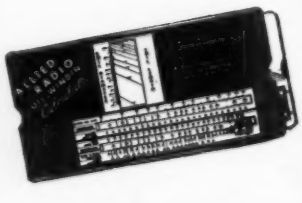
Allied's "specialists" give technical aid . . . or expedite procurement of many diversified needs.

Wherever you are . . . whatever you require . . . call ALLIED *first* for fast, efficient service!

Write, Wire or Phone Haymarket 6800

ALLIED RADIO CORP.
833 W. Jackson Blvd., Dept. 1-D-5, Chicago 7

REPAIR AND REPLACEMENT PARTS AVAILABLE WITHOUT PRIORITY



NEW Rapid R-F Resonance and Coil Winding Calculator

New, dual-purpose Calculator devised by Allied for fast and accurate determination of resonance factors and coil winding data. Simple, easy to use. Send for it now. No. 37-955.
Price net, only.....25c

6 VALUABLE RADIO BOOKS FOR 75c

Specially prepared by technical experts for radio training and for helpful reference. Priced only to cover cost of preparation and mailing.

RADIO BUILDERS' HANDBOOK. Simplified theory and projects. No. 37-750 . . 10c

RADIO-FORMULAS & DATA BOOK. Handy, pocket-size manual. No. 37-752 . . . 10c

SIMPLIFIED RADIO SERVICING. Short cuts in trouble-shooting. No. 37-755 . . 10c

DICTIONARY OF RADIO TERMS. Easy-to-understand definitions. No. 37-751 . 10c

RADIO CIRCUIT HANDBOOK. Schematics and Pictorials. No. 37-753 . . . . 10c

RADIO DATA HANDBOOK Formulas — Tables — Charts No. 37-754 . . . . . 25c

ALL SIX BOOKS No. 37-799 . . . . . 75c
Write for Quantity Quotations

ALLIED RADIO CORP., Dept. 1-D-5
833 W. Jackson Blvd., Chicago 7, Illinois
Please send the following items ($_____enclosed)

☐ 37-750 ☐ 37-752 ☐ 37-754
☐ 37-751 ☐ 37-753 ☐ 37-755
☐ All 6 Radio Books ☐ Free Catalog ☐ Calculator

Name_____
Address_____
City_____State_____

ALLIED RADIO
In the Heart of America's Transportation System

should have arrows on them pointing in the direction that a positive charge, if placed near any electric charge, whether positive or negative, would go. This means that if a certain space were filled with protons or positive charges, then all the lines of force would point away from these positive charges since they would repel an exploring positive particle in this field. On the other hand, negative charges would attract this exploring positive charge and so the arrows on the lines of force connected with negative charges point toward the charge itself. All this sometimes tends to be confusing and so it is better to just think of these lines of force as an actual force which will attract oppositely charged particles and repel like charges.

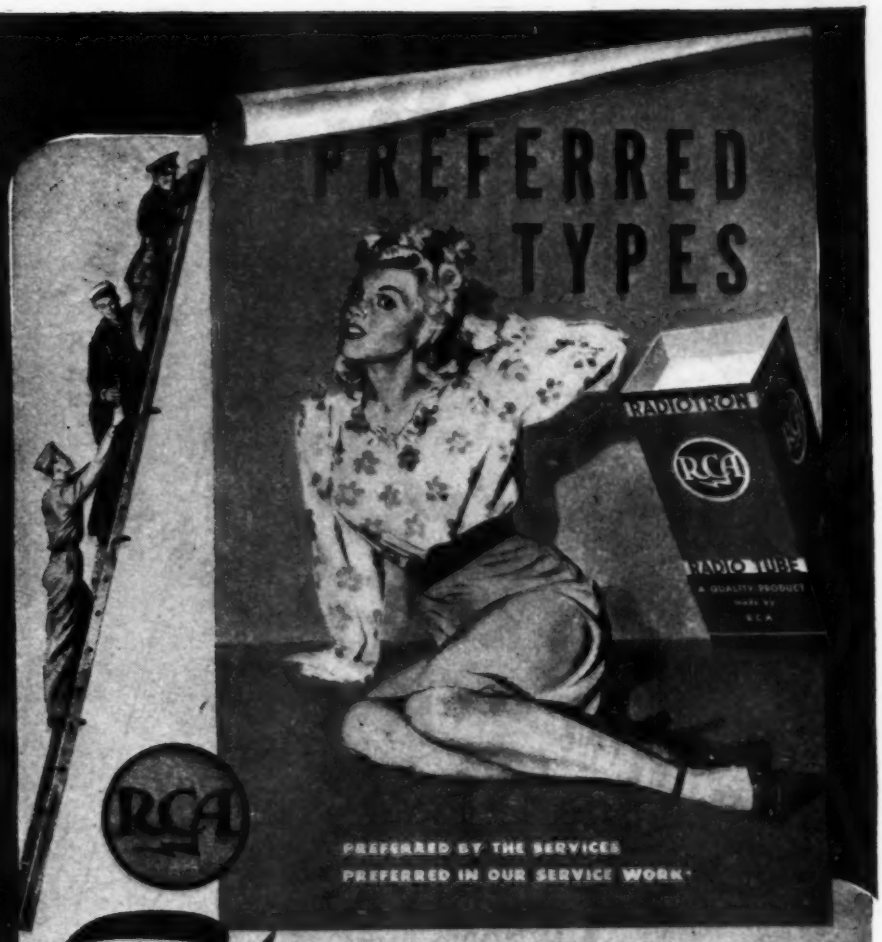
With this in mind, no confusion should result. These lines of force are continuous, starting out from positive charges and ending up on negative charges. Should the space in question contain only positive charges, then the lines of force due to these charged particles will continue indefinitely out into space toward infinity, and a force would everywhere be felt. This is theoretically true but in an actual case the effect of its electric intensity would be confined to the immediate vicinity since from Coulomb's Law it can be seen that force varies inversely as the square of the distance. At a distance of say 8 centimeters from a charge the force would be $\frac{1}{16}$ of what it is at 2 centimeters from the same charge, so it is obvious that no great distance is needed before the over-all effect of the electric field is negligible. A clear idea of the way these forces decrease with distance can be obtained from Fig. 1.

Dynamic Electricity

Turning now from the static case, let us put an electric charge (for example, an electron) into motion and see if any new facts are discovered. The easiest method of accomplishing this end is to use a conductor, that is, a substance that contains a large number of free electrons. Since the free electrons will experience a force when any electric field is brought to bear on them, they will be forced to move and the number that will flow past any point in this conductor will be determined by the strength of the electric force that is causing them to move plus the ease with which they can travel through this conductor. Does the last statement sound familiar? It should, for although it is never stated this way, it the good old formula $E = IR$ which is Ohm's Law. Note that a steady electric field or electric force is used here—a situation that is true for direct-current circuits.

Since the electron has a charge it will produce an electric field. But it has been found on investigation that when put into motion the electron will likewise give rise to a magnetic field. In 1819 the Danish physicist Oersted discovered that current in a wire affected a compass that was held near

Get this Display!



Preferred Type TUBES

*RCA DEVELOPED AND INTRODUCED MORE TUBES ON THE JOINT ARMY-NAVY PREFERRED LIST OF VACUUM TUBES THAN ANY OTHER MANUFACTURER

How about putting this beautiful salesgirl to work for you?

Let her sell your customers the idea . . . quality tubes mean quality service. Identify yourself with the progress and future implicit in the fact that RCA developed and introduced more tubes on the joint Army-Navy Preferred List of vacuum tubes than any other manufacturer . . .

Let people know you are actively in business and are there to stay! Get your Preferred Type Display from your RCA distributor . . . today.

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

LEADS THE WAY . . . In Radio . . . Television . . . Tubes . . . Phonographs . . . Records . . . Electronics

TURNER
Microphones
PIONEERS IN THE COMMUNICATIONS FIELD
A
22D
DYNAMIC
A
Ace High In Performance
Modernly styled, ruggedly built, yet precision engineered to deliver accurate transmission of any given sound with unfailing dependability, TURNER 22D Dynamic microphones have won world-wide reputation for ACE HIGH performance under any climatic or acoustic condition. In demand today for essential communications, 22D has wide application in military and industrial areas as well as for critical recording, P.A. or broadcast work.
When you build or design electronic communications equipment it will pay you to investigate . . . and TURN to TURNER for ACE HIGH performance. Write today for Free TURNER Catalog giving pertinent information on all TURNER Microphones.
Turner
MICROPHONES
99
211
9D
Free Turner Catalog.
Write for your copy.
The TURNER Company
CEDAR RAPIDS, IOWA

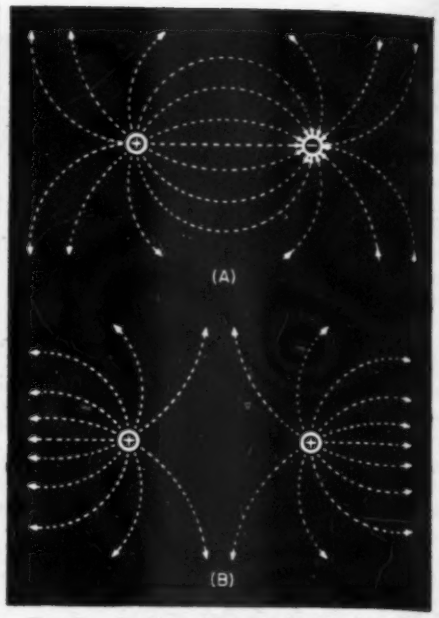


Fig. 5. Configuration of electric lines of force. (A) for attraction and (B) repulsion.

this wire. Since compass needles will only move under the influence of magnetic fields, Oersted concluded that there must be a magnetic field about a wire carrying a current.

A little while later Ampere carried this one step further and showed that two wires with currents in them exerted forces on each other. With the two wires separate and distinct from each other it must have been the magnetic field that reacted. It is from the above that the first ideas on the relationship between electric and magnetic fields were brought into existence and slowly started the trend that ended with Maxwell's formulation of the electromagnetic theory.

The type of magnetic field produced depends on the type of electric current that is flowing in the wire. A steady flow of electrons will produce a magnetic field that is likewise constant in value, while changing magnetic fields are the product of changing electric currents.

This idea of electric currents giving rise to magnetic fields was proved time and again and was accepted without question in the 19th century. However, in the theories that Faraday and, a little later, Maxwell envisioned about electrodynamics, there was more to the story than just the above. Must currents always be present for magnetic fields to occur?—questioned Maxwell. Was it not possible to deal only with a varying or changing electric field and derive magnetic effects from this? Maxwell claimed that it was possible and so added this revision to the existing electric field equations that were accepted at that time. He postulated two types of currents; one was called conduction current and this was our ordinary flow of electrons along any good conductor. The second type of current, due not to actual moving electrons but rather changing elec-

(*Continued on page* 138)

NATIONAL RECEIVERS ARE THE EARS OF THE FLEET

OFFICIAL U. S. NAVY PHOTOGRAPH

Three out of four of the Navy's ships — landing craft or larger — are equipped with receivers designed by National.

The photograph above was taken from the deck of the USS Tulagi, participating in the August, 1944, invasion of France. Modern amphibious operations require superb radio communications.

HRO

NC-200

NATIONAL COMPANY

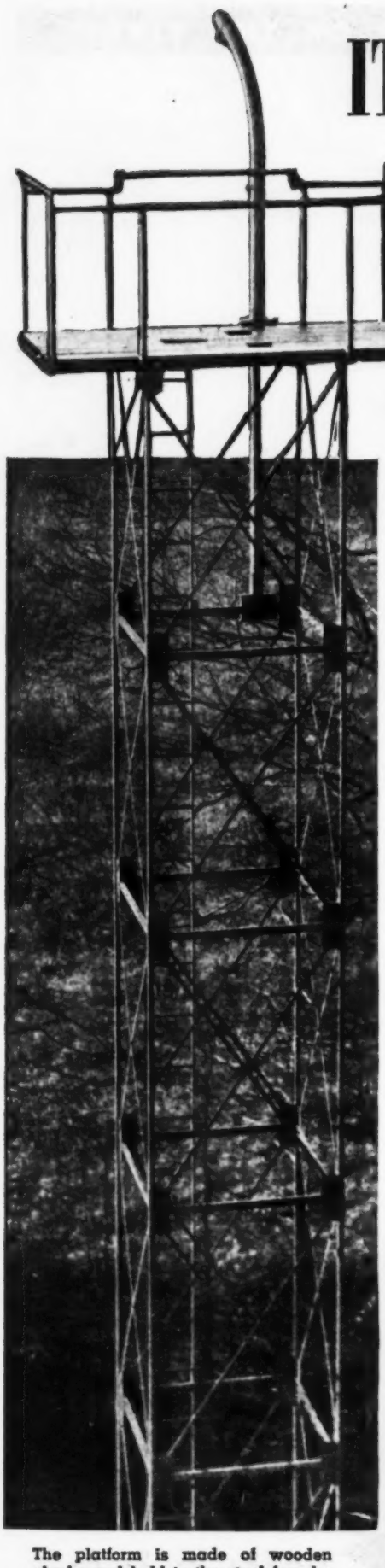
MALDEN MASS, U. S. A.

NATIONAL RECEIVERS ARE IN SERVICE THROUGHOUT THE WORLD

IT'S A BANTAMWEIGHT

This high strength-to-weight ratio radio tower marks unique design for 4-post-type installation.

By HAROLD COHEN
Pres., Harco Steel Const. Co.



The platform is made of wooden planks and held to the steel foundation with clip bolts. The tubular railing fits securely into metal collars.

WARTIME jobs for radio masts and towers are exacting. Structures have to be rugged, rigid, yet lightweight. They have to be assembled easily, erected quickly and safely. They must make good under strain of adverse conditions, including ice, snow, and high wind velocities.

Such were the exacting requirements of the Armed Forces which Harco Steel Construction Co. of Elizabeth, N.J. met with its ingeniously designed radio masts and towers. Latest of these is the *Bantam King* illustrated here. Like the other Harco units the *Bantam* is also seen having applicability postwar, not only in communications work but in other directions.

Briefly, the *Bantam King* is a guyed four-post steel tower, 4' square, available in heights of 30', 50', or 100' and in intermediate multiples of 6'. Tower is surmounted by a 1¼" wood plank platform, approximately 4'x8', enclosed by a pipe railing 3' high, with a convenient hinged gate. A boom and winch is connected to one side of the top section to facilitate erection of equipment on platform. Ground anchors are of the screw type. Each of the four guy wires has one turnbuckle. The unit can be erected on the ground as a portable tower, or installed permanently in concrete foundation.

No rivets are used in erection. Except for the bolts to make field connections, towers are of welded construction throughout. In spite of the light weight (average weight of each member is only 7 lbs.), extreme rigidity is attained through use of a total of 24 connections in each section.

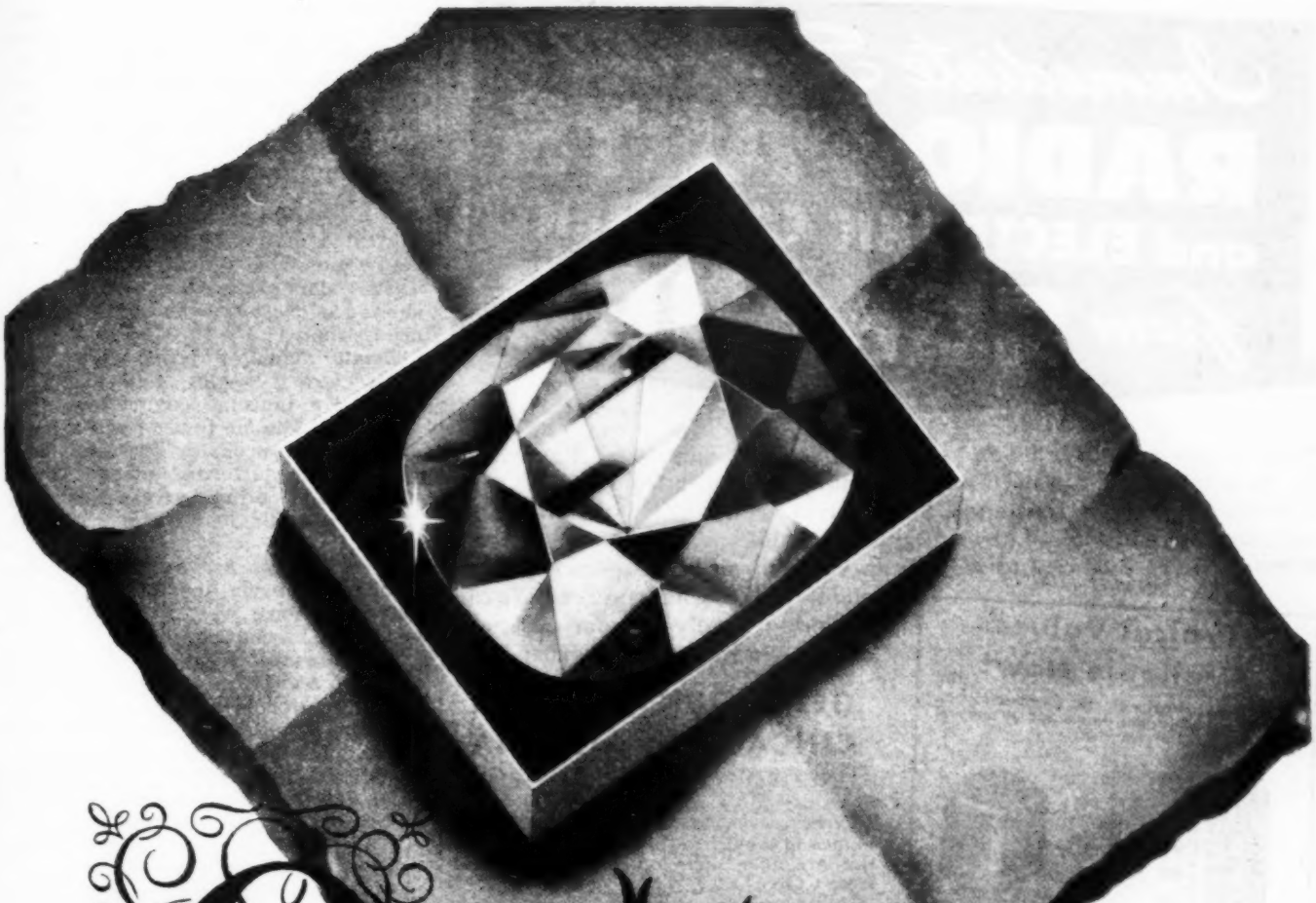
Erection has been reduced to minimum effort and maximum simplicity. You do not need complicated blueprints, nor a crew of professional riggers. Within two hours, three untrained men can easily erect a 30' tower. Interchangeable members forestall errors. So do the simple connections, which can be made only in one way.

First, the four corner base plates are set, then the initial sectional unit is fastened to the base with three bolts at each corner post. Adjustment of these bolts provides accurate starting level.

Posts are identical and each is easily inserted in the sleeve of the post below. You do not need to hold the post

The tower is constructed in sections. Workmen are bolting into position the X-bracing of one of the sections.

The tower is leveled at the base by adjusting three bolts and two nuts on each of the four corners.



Quality Counts

THE Koh-i-nor is one of the world's most magnificent diamonds. Weighing 106-1/16 carats, it is famous for its brilliance and luster. Of course, a diamond is considered supreme as a jewel because it is the hardest, most imperishable and most brilliant of all gems. The Koh-i-nor's reputation places it in a separate class apart from other diamonds due to its flawless quality — a true example of the fact that, with any product, *Quality Counts.*

THE WARD PRODUCTS CORPORATION, realizing this fact, has long been the leader in the manufacture of one-piece and sectional antennas for automobile and home radios. **WARD** products are quality products, the workmanship of craftsmen using modern equipment under ideal conditions. Many important design changes pioneered by **WARD,** have become accepted standards in the industry . . . For quality antennas for all applications, look to **WARD.**

WARD *Antennas*

BUY WAR BONDS

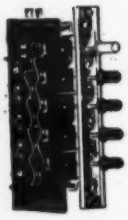
THE WARD PRODUCTS CORPORATION
1523 EAST 45th STREET, CLEVELAND 3, OHIO

Immediate Shipment! RADIO PARTS and ELECTRONIC EQUIPMENT *from* CONCORD

What do you need in radio and electronic parts or equipment? If you think it's hard to get—if you need one or a hundred—order from CONCORD, by mail, by wire, by telephone. Our shelves are loaded with top-quality merchandise, nationally-known brands, complete assortments. Our radio technicians are prepared to work with you and expedite special requirements. Tell us what you need. We can probably supply it from our huge stocks—and ship it to you at once.

Typical Values Available Now!

Money-saving prices on the four parts listed below are typical of thousands of unusual values offered by Concord.



Push Button Switch, 4 Sections, each 8 pull double throw, with release button as illustrated.
5B4029
Specially priced, 89¢

Full Wave Vibrator Transformer, 6 Volts. Input—250 Volts. 60 MA. Output C.T.
5B5000
Specially priced, 79¢

I. R. C. type CS Dual Potentiometer 2500 ohm and 25 ohm.
5B2007
Specially priced, 49¢

Cornell-Dubilier type TJL6040, 4 mfd. 600 volt DC wkg. oil filled condenser.
5B3015
Specially priced, $1.49

GET IT QUICKLY—from CHICAGO or ATLANTA

CONCORD is geared to present-day demands for fast service. Government, Industry, and Institutions—the biggest names in America—have discovered that they are more likely to get what they want from CONCORD, and get it sooner. Two huge shipping warehouses, one in CHICAGO and another in ATLANTA, are ready to fill and ship your orders immediately, no matter how large or small, no matter where you are located.

FREE! NEW 64-PAGE "Book of Values"

This big 64-page showing of available-now parts for radio and electronics will be ready about April 1st. It offers thousands of hard to get parts at substantial savings. Includes new 1945 Revised Listings of standard lines of Condensers, Transformers, Resistors, Test Equipment and other essential radio parts. Rush coupon for FREE COPY—mailed to you as soon as printed.

CONCORD RADIO CORPORATION

Lafayette Radio Corporation

265 Peachtree Street ATLANTA 3, GA. ★ ★ ★ 901 W. Jackson Blvd. CHICAGO 7, ILL.

RUSH FOR FREE 64-PAGE "Book of Values"

CONCORD RADIO

CONCORD RADIO CORPORATION
901 W. Jackson Blvd., Dept. E-45
Chicago 7, Illinois
Please send me a FREE copy of the "Book of Values" of radio and electronic parts and equipment as soon as it's off the press.

Name.....

Address.....

City.....State.....

in place while making this connection. Nor is it necessary to bolt the posts together. The only bolting needed is that of horizontals and diagonals to gussets. Erection proceeds, sectional unit by unit, until tower is completed and the platform is installed.

Design specifications are stiff: A vertical load of 500 lbs. at platform and horizontal load of 420 lbs., concentrated at a point 6' above top of tower plus wind velocity of 100 m.p.h. Tests simulating these conditions showed deflection at top of 30' tower of less than 1".

Small diameter posts, flat diagonals, nested angles, and channels, make for unusual compactness for shipping. The 30' tower itself weighs only 596 lbs.; occupies only 8 cubic ft. With base, platform, ladders, boom, winch, and other accessories, the weight is 1,538 lbs. and space is 37 cubic ft.

These figures are for a tower designed for unusual loadings. For normal conditions, weight and shipping space can be considerably reduced.

These towers provide ideal supports for v.h.f. and FM antenna arrays. The roomy platforms are especially suitable for installation and servicing of stationary and rotary beam antennas. The free space down center of tower from platform to ground allows for rotary beam drive shaft mechanism.

Television, radar, airport rotating beacons, forestry observation posts, and wind turbine supports, are among other applications forecast for these versatile and sturdy towers.

-30-

FINE RESISTANCE WIRE, THE SMALLEST COMPONENT OF WAR

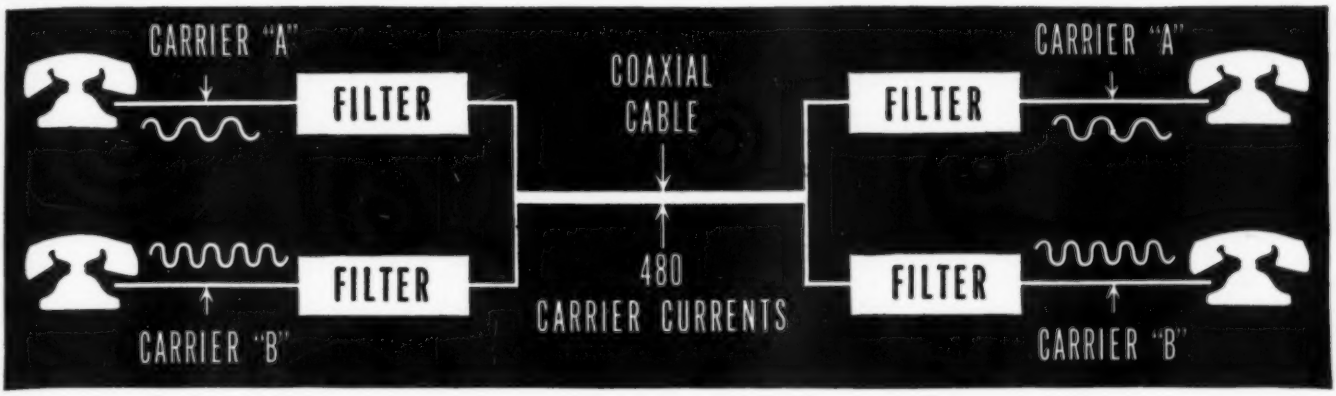
FINE resistance wire, made of 80 per cent nickel and 20 per cent chromium, is a modern triumph of cooperation between industry and the United States Army Signal Corps. It is being used in communications equipment in the hottest battles, yet it is considered to be "the smallest component of war." The diameter of this wire is as small as .0008 of an inch, which is about one-fourth the diamater of an average human hair. For purposes of insulation, it is treated with three to six coats of enamel, which is baked on in successive operations.

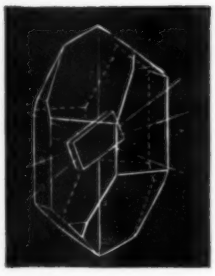
It is a fact—though hard to believe—that ninety miles of wire, and that is 475,000 feet, can be produced from a single pound of the nickel and chromium alloy mentioned. A ton of the alloy would provide approximately 200,000 miles of wire. Its high tensile strength makes such fine drawing possible. Copper, with less tensile strength, would snap before such fineness could be reached.

The finest-drawn nickel and chromium wire is used for precision-type resistors of certain radios. It will handle up to two watts in radio receivers and has a resistance of 650 ohms per circular mil foot. Inspection limits for the wire permit a variation of one-half of one degree of resistance.

-30-

Crystal gateways for your voice





Four hundred and eighty telephone conversations over a coaxial cable was one of the last peacetime achievements of communication research in Bell Telephone Laboratories. In this multi-channel telephone system, each conversation is transported by its own high-frequency carrier current. At each end of the line are crystal gateways; each opens in response to its own particular "carrier" with the message it transports. In telephone terminology, these gateways are filters.

The ultra-selective characteristic of these filters is made possible by piezo-electric quartz plates, cut in a special manner from the mother crystal, and mounted in vacuum. Each set of plates is precisely adjusted so that the filter responds only to the frequency of its assigned channel, rejecting all others. In the coaxial terminal equipment, such crystal gates sort out messages for delivery to their four hundred and eighty individual destinations.

In recent years, Bell Telephone Laboratories research has provided the Armed Forces with many types of electrical equipment in which frequency is controlled by quartz crystals. Notable is the tank radio set which enables a tank crew to communicate over any one of 80 different transmission frequency channels by simply plugging in the appropriate crystal. The future holds rich possibilities for the use of quartz crystals in Bell System telephone service.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting for our Armed Forces at war and for continued improvements and economies in telephone service.

KILLION'S Wartime Plans

By EUGENE A. CONKLIN

How one radio-service dealer maintains a profitable business despite material and labor shortages.

VERY few radiomen prefer the flat rate as applied to set servicing. Killion's of Utica, N. Y., is one of the minority who not only believe that it's practical to service at a flat rate—but makes money by so doing. Here's the Killion success story.

Killion has a special flat rate of $5.00 if the set is brought to the shop —$6.00 if home pickup and delivery is desired—$7.50 if home servicing is required. The customer has his or her set put in tip-top condition—with all work except tubes guaranteed for thirty days only, due to the wartime part-replacement situation.

On the other hand if the customers desire, they may pay $1.50 an hour-service rate, plus replacement costs if they dislike doing business on the "flat rate" basis.

Killion makes no attempt to discourage pickup and return of radios to the customers' homes. A flat charge of 50¢ is made for all pickups and an equivalent amount for all "returns." Killion's states this charge frankly in its telephone directory ad and its newspaper copy.

How does Killion justify a flat rate in wartime? First of all he makes no estimates—it's either flat rate or on an hourly labor basis. Flat-rate work—brought in the shop, or pick-up—requires three days minimum; per hour service work is given immediate 24-48 hour attention. In order to cut labor costs—all sets brought into the shop for service are given preliminary checking by a shop assistant who tests for tube defects or loose wiring. If defects show up in these "preliminaries"—well and good. Shop assistants are housewives who come in for 5-hours daily. Also Killion is using two ex-Servicemen who learned radio in the service and are making use of their knowledge now. Ex-Servicemen work only five hours a day also, being replaced by the housewife shift.

The housewife shop assistants handle tube checking and routine work—the Servicemen tackle more involved service problems. Assistants also make pickups and deliveries—for half of their shift—every other day. It gets the Servicemen out in the air, makes their adjustment to civilian life just that much easier.

Killion remains open all day Sunday from 9 A.M. till 9 P.M. He asks all civilians who can't bring in sets during week days to do so on Sunday when defense duties do not keep them busy. Also, on Sunday he specializes in auto radios of defense workers who need their autos to get to work on week days. Military personnel on weekend leaves usually descend on this serviceshop on Sundays making this day of rest a busy one indeed. Killion feels this is a wartime necessity in view of the fact that defense workers and Servicemen or women can't very well do business during the weekday period.

This repairman also makes no tube sales over the counter or elsewhere—only bona fide service jobs get tubes installed. Tube checking at the shop is not handled—the set must be brought in. This is a radical move but there has been no "customer kick" as yet. Killion explains to customers who do bring tubes in that such checking activities would require considerable time on the part of the service shop personnel.

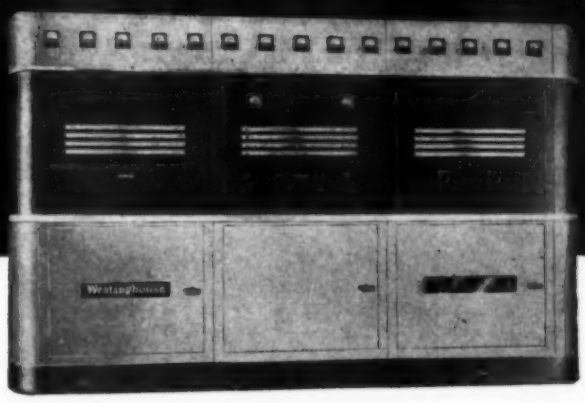
Killion has a special checkup service for radio-phonograph combinations. He'll check such units for $10.00 in the home, paying especial attention to tonal quality. Customers with combinations are usually "tonal response bugs"—the slightest surface noise or distortion and they're annoyed, to put it mildly. Killion attempts to reach such individuals who, many times, are defense workers who've put their surplus, aside from War Bonds, into a combination model. He does this by means of personally-typed letters to all lawyers, doctors, musicians, professional men and women, and adding from 15 to 25 defense workers to the list each month. 150 personal letters explaining his "combination checkup" go out on the 1st, and another 150 on the 15th of the month. He has a local high school girl act as typist. He finds that though some who receive his letters haven't combination radios, they will, nevertheless, call upon him for service the next time their receiver is in need of it.

He also has a "kink" worth mentioning—renting radios and installing radios for those who land in the hospital unexpectedly through an accident or sudden sickness. He'll bring their house radio, portable—or rent them one from his stock of used sets —install it in their private or semi-private room if they desire. He uses

"My, my, you certainly must have been hungry!"

HERE'S ONE OF THE SECRETS OF HIGHER FIDELITY

IN WESTINGHOUSE TRANSMITTERS



Easy operation is another keynote of the smartly-styled Westinghouse 5kw transmitter . . . one master switch puts the transmitter on the air and cuts off power at close of broadcast day. Controls reset automatically whenever overloads occur in any circuit for any reason.

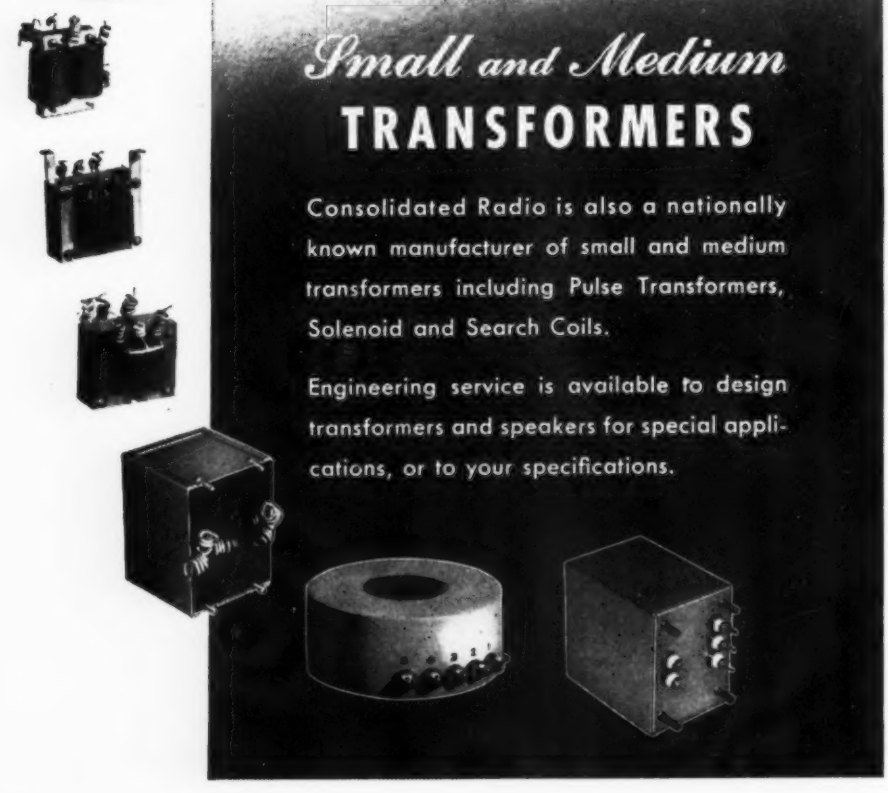
Here's one of the secrets of the higher fidelity in Westinghouse 5 and 10kw transmitters: it's called equalized audio feedback (see drawing) and it's an outstanding contribution to higher signal fidelity.

Equalized audio feedback strengthens the already high fidelity of the audio and modulation circuits in Westinghouse transmitters, and reduces audio distortion to even lower limits. The system is independent of any variation in rectified antenna output.

Control-simplicity, economy and high fidelity are natural partners of the solid dependability you find in the complete line of Westinghouse transmitters . . . 5, 10 and 50kw AM and 1, 3, 10 and 50kw FM. Your nearest Westinghouse office has all the facts on these newest achievements in faithful transmitter operation designed by Westinghouse . . . the oldest name in broadcasting. Westinghouse Electric & Manufacturing Company, P. O. Box 868, Pittsburgh 30, Pa. J-08110

XXV—RADIO'S 25TH ANNIVERSARY—KDKA

Electronics at Work

RADIO SPEAKERS
for all applications
Recently expanded production facilities combined with complete engineering "know-how" enable Consolidated Radio Products Co. to supply the finest radio speakers available. Speakers can be furnished in the following ranges:
Dynamic Speakers from 2 inches to 18 inches
Permanent Magnet Speakers from 2 inches to 18 inches
Headsets
Electronic and Magnetic Devices
CONSOLIDATED RADIO
Products Company
350 W. ERIE ST., CHICAGO 10, ILL.

Small and Medium
TRANSFORMERS
Consolidated Radio is also a nationally known manufacturer of small and medium transformers including Pulse Transformers, Solenoid and Search Coils.
Engineering service is available to design transformers and speakers for special applications, or to your specifications.

a newspaper ad on the same page as news of local individuals who are in the hospital is carried—this ad specifically plugging his "hospital or nursing home" radio service.

In addition, he keeps an ad in the classified "For Rent—Rooms and Apartment" column offering to install portables or house radios.

Summing it up, Killion believes that volume is the secret of success—even in wartime. He points out that between housewives, school children, and returning war veterans, the help situation is easy. Tubes are coming in a bit more readily, though still nothing to brag about. And postwar business will depend upon customers who are added to the serviceman's fold *now*, not at some all too indefinite date in the future.

—30—

AMATEURS IN THE CAP

"HAM" radio operators, whose wartime dreams have been haunted by wistful echoes of calls to New Orleans, and faint signals from Bangkok or Brest, are now being offered a new opportunity to start the wavelengths bouncing again, and be of service to the war effort as well.

The Civil Air Patrol, civilian auxiliary of the Army Air Forces under the 32nd Army Air Base, has need of radio experts in its Communications section, to build sending and receiving sets to be used for training pilots and cadets. The CAP can obtain from time to time some of the vital parts needed for such sets . . . others may have to be devised or converted by the radio men themselves.

Types of sets needed include A-1 (pure c.w. code transmission), A-2 (tone modulated c.w.), and A-3 (voice modulation), for use on 115.2 to 116.0 megacycles. Sets built in Chicago will be leased to the CAP Illinois Wing Commander for the duration of the war, but will be held and operated by the builders themselves, provided they hold a CAP operator's license.

It is estimated by amateur radio club members, many of whom have expressed great interest in the new CAP program, that there are approximately 200 "hams" now in Chicago who might be expected to participate. Many of them have been doing excellent work for the War Emergency Radio Service as well. However, sets now licensed for WERS work cannot be used for the CAP duties; and a WERS operator's license cannot be used in the CAP, but will entitle the operator to apply for a CAP license.

Radio operators who enlist in the program would become members of the Civil Air Patrol, entitled to wear the regular uniform of that organization, and subject to all its opportunities, privileges, and regulations. The type and power of sets to be used are identical with those used in the WERS, and models of them are now set up at the south side headquarters of Group 613, CAP, at 8012 S. Cottage Grove Ave.

Anyone in the Chicago area interested may obtain further information from Major E. L. Masterton, Commander of Group 613, at 8055 S. Luella Ave., telephone Regent 1700; or from Capt. A. H. Knodell, Communications Officer for the Illinois Wing, at 5746 N. Artesian Ave., phone Longbeach 9627.

—30—

SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men

You Can Get KOOLOHMS Now!

At last, greatly expanded production is beginning to match even the tremendous war equipment demand for Sprague KOOLOHM Resistors. As a result, we have been delivering good quantities of 5- and 10-watt sizes in all ranges to Sprague distributors—and hope soon to make a similar announcement, both with regard to KOOLOHMS in other sizes and to many of the previously unavailable Sprague Capacitor types.

As always, we'll appreciate it if you ask for them by name!

WANTED—Reasonably priced vac. tube testet and ohmmeter, also any other test eqpt. Thurman Tucker, Rt. No. 5, Box 481, High Point, N. C.

FOR SALE—Stancor 510 amplifier, Thordarson 2A3 true fidelity phono amplifier; Turner 22X and BX mikes; 8" Jensen PM speaker in cabinet, all new, complete with tubes. Want hi-fidelity TRF PA and FM tuners. John Repa, Jr., Main St., Richlandtown, Pa.

WANTED—Philco # 42-123 1½-volt radio receiver, without battery. Joseph A. Salla, Plaza, N. Dak.

TRADE OR SELL—16-tube Midwest cabinet radio in good condition, excellent tone. Want sig. generator or FM tuner or converter. Harold A. Robertson, 628 Frederick St., Cumberland, Md.

WANTED—Spring wound phono motor and turntable, portable size preferred; also phono pickup, either crystal or magnetic, but crystal preferred. L. J. Weisford, Shepard, Alberta, Canada.

WANTED—2-W-3; 5-Z-4 or 5-Y-4-G, or 6X5G or 7Y4 or One V tubes. Cash or trade hard-to-get 7B7, 12SQ7GT, 1A4, 1B4, 1C6, etc. even. Also need 2" oscilloscope and sig. generator such as Precision E-200. R. N. Eubank, 1227 Windsor Ave., Richmond, Va.

WANTED—Tubes new or used: 12SA7; 12SK7; 12SQ7; 12SG7; 1A7; 1N5; 1H5; 3Q5; 35L6; 50L6; 25L6; 35Z4; 35Z5; 25Z6; 25Z5; 6A7; 12A8; 12Q7; 117Z6. All letters answered. O'Brien's Radio, 164 W. 2nd St., Fulton, N. Y.

FOR SALE—Radio tubes, instruments and supplies incl. 12SQ7; 12SK7; 50L6; OZ4; 6SA7; 6SK7, etc. Only 1 to 8 of each kind. John J. Trowbridge, 7936 Parnell St., Chicago 20, Ill.

WANTED—Adapters to take latest tubes, also chart for same. To be used in Confidence tube tester # 36. Also need hard-to-get tube types. Russell Sands, 5722 Reedland St., Philadelphia 43, Pa.

FOR SALE OR TRADE—Philco sig. generator # 088, battery operated, incl. instructions. What have you? Would like small 5-tube Emerson or RCA radio using 12SA7, 12SK7, etc. Joseph H. Kellner, Box 165, Pine Bush, N. Y.

NOTICE!—Please write plainly and describe your equipment accurately when sending advertisements for THE TRADING POST. This will help simplify our job of handling a tremendous number of ads every month—and will assure prompt, accurate presentation of what you have to sell or what you want to buy.

FOR SALE—Riders Manuals 6-7-8-9-10-11-12, list price; also small lot of 6v, 12v, 25v and 50 volt tubes, OPA list for new, 30% off for tested used tubes. H. J. Miller, 222 Fourth St., Lock Haven, Pa.

WANTED—0-1 ma. a-c; also 0-1 d-c, State condition & price. M. P. Hemphill, 6044 Buena Vista Terrace, Los Angeles 42, Calif.

WILL EXCHANGE a Triplett # 321 0-100 microamp. meter for a 0-1.5 milliamp. meter, any model. John D. Young, 213 Green St., Mifflinburg, Pa.

WANTED—Rider or Meissner channel analyzer, radio tubes, mica condensers, resistors (wire wound), meters and signal generator. Penn Electronics Co., 229 Maclay St., Harrisburg, Pa.

WANTED—Modern tube checker, also signal tracer and other test instruments reasonably priced. Have 2 electropak 115v line battery chargers, also 3 RCA 100-A magnetic speakers. Joe O. Miller, 2282 Loth St., Cincinnati 19, Ohio.

SWAP OR SELL—Have Hickok AC51 tube tester, modernized, tests 117v tubes; also volt-ohmmeter. Want Superior channel analyzer and condenser tester. H. R. Hover, Box 98, Santee, Calif.

WANTED—Set of Rider's Manuals; one record cutter head and motor or complete recording outfit; one condenser tester; one a-c O-20 ammeter and a-c O-500 voltmeter. H. C. Wehrle, Waucoma, Iowa.

WANTED—25D8GT; 1G5G; 50L6; 35L6; 35Z5; 1H5; 1N5; 12SA7; 12SQ7 or what have you, new or used? Cash or what do you want in exchange? H & H Radio Service, 15th St. & 7th Ave., Rock Island, Ill.

URGENTLY NEEDED—1-1A7G; 1-35Z5; 1-35L6; 1-12SG7. Also want test equipment of any type, small radios, parts, and 8 mm movie camera. All letters answered. W. O'Brien, 164 W. 2nd St., Fulton, N. Y.

TUBES FOR SALE—2-1A4; 3-1C6; 1-1C7; 2-1D5G; 1-1F5G; 1-1F7G; 1-1G5G; 1-1H6; 3-2A5; 3-15; 2-22; 3-31; 1-32; 1-33; 2-34; 1-49. New, in original cartons. 40% off OPA list. You pay shipping. North Branch Radio Shop, North Branch, Mich.

FOR SALE—Readrite signal generator # 557, battery operated in A-1 condition. Want recorder and playback eqpt. or phono record player, also 25Z5 tubes. A. V. Larson, 822 4th St., Madison, Minn.

FOR SALE—PL-20 Brush pickup and G. I. dual speed phono motor. Also tubes, amplifiers and mikes. What do you need? H. Glenwood Schlegel, Hummels Wharf, Penna.

WANTED AT ONCE—Sig. generator and signal tracer, must be A-1, for cash. John M. Webb, Henderson, Tenn.

METER FOR SALE OR TRADE—Westinghouse heavy-duty type TM a-c ammeter 0-120 amps. 45-65 cycles 9½"x5". Walter Zucker, U. S. Coast Guard, 115 Empire Blvd., Brooklyn 25, N. Y.

WANTED—Signal generator, preferably Precision E200, also output meter. L. C. Conner, 61-09 77th St., Elmhurst, L. I., N. Y.

WANTED FOR CASH—Radio tubes, receiving sets, and small public address system. H. G. Radcliffe, 1013 High St., Petersburg, Va.

FOR SALE OR TRADE—Brand new Triplett # 666 VOM; new Weston 0-1 mil. # 301; Weston # 301 surface mount 0-300 m.a.; tubes, used but guaranteed, 6C6, 6D6, 6H8, 76, 2A6, 57, and 58. 50% off list. R. K. Wheeler, 2523 Central Ave., Indianapolis, Ind.

WANTED—Supreme # 585 diagometer wired to test all tubes, also a-c sig. generator such as Supreme, Precision, etc. L. R. Collins, 142 So. Forest Ave., Rockville Centre, L. I., N. Y.

TO TRADE—2-35Z5; 2-12SK7; 1-1A7; 1-1H5; 1-12Y5; 1-OZ4. Want 2-35L6; 1-35Z6 or 25Z6; 2-12SA7; and 1-12Y7. For sale: 18-watt amplifier complete with turntable, pickup, 2-W.P., PM, 2-DY, speakers, 2 inputs microphone 200 ft. hookup wire, all A-1, $55 cash. M. J. Logsdon, Vine Grove, Ky.

FOR SALE—New tubes in factory-sealed cartons: 1A5's; 1C5's; 1Q5's; 1S4's; 6AC5's; 6L6's; 6H7's; 6SJ7's; 6SS7's; 7B6's; 7Y4; 12SC7's; 12SG7's; 14B6's; 35Z3's; 1235's, 41's. Must sell all to one buyer. Square Deal Radio, 10 E. Bancroft, Toledo, Ohio.

WANTED FOR CASH—All-wave sig. generator; RCP # 803-A tube tester, # 414 universal multitester, condenser tester, and RCA-Rider Chanalyst. Vincent, Pizzurro, 3453 Avondale Ave., Normandy, Mo.

WANTED FOR CASH—Tube tester in A-1 condition with miniature and loctal tube sockets. What have you? Wilts C. Hanks, 526 Escort St., Orange, Texas.

FOR SALE or will trade for records: 1-6K8; 1-12Z5; 1-1J5; 2-6P5; 4-7C5; 1-3Q5; 3-6X5; 1-6V5; 3-6F6; 1-31; 1-42; 2-6K7; 2-6C5; 4-6W5; 1-12Q7; 1-12SQ7; 1-6SK7; 1-SJ7; 2-50L6; 1-35Z5; 1-25Z5; 1-12SK7; 1-6A8; 1-8A7; 1-6N7; 1-26L6. Will sell entire lot for $30. J. Sanford Martin, Room 9, YMCA, Danville, Va.

IF YOU APPRECIATE the Sprague Trading Post service, we know we can count on you to ask for SPRAGUE Capacitors and SPRAGUE Koolohm Resistors by name whenever you buy. They will not let you down!

FOR SALE—10-watt amplifier with 12" speaker, Xtal mike & phono inputs, 6SJ7; 6N7G, 1P 6L6, 80. Speaker in leatherette case, $25 f.o.b. Also have new tubes such as 24A, 6L7, 1F6G, etc. Frank's Radio Lab., New London, Iowa.

WANTED—All std. radio tubes, old radios, professional recorders, phono pickups, and motors. Midland Radio Service, 211½ N. Broadway, Billings, Mont.

SELL OR TRADE—Pair of HK24's, used only a few hours, in original cartons, $4 each, or will trade. What have you? Melvin G. Roppelt, 606 S. Ellwood Ave., Baltimore 24, Md.

FOR SALE—1R5; 1LH4; and 1H5 tubes. Want 1A7; 1P5 tubes, also sig. generator or any instrument to align receivers, preferably battery operated but will buy any. G. W. Selby, Columbia, N. C.

WANTED—Signal generator and other test equipment. W. A. Spain, 1041 Hornet Circle, Ferguson Park, Newport News, Va.

FOR SALE—# 1213 new portable Triplette tube tester; also one # 900 Technical Apparatus all-wave sig. generator in perfect operating condition. Both for $100, or will trade for oscilloscope of equal value. E. W. Tarlan, Radiocraft Laboratories, 4668 Homer Ave., S. E., Washington 20, D. C.

WANTED—6v d-c gasoline plant in excellent condition. Gifford Pinchot, 1615 Rhode Island Ave., Washington 6, D. C.

WANTED FOR CASH—L49B, L80B ballast tubes; 25L6; 25Z5; 6C6; 6D6; 6U5; 35L6, etc. Also want good used radios. Cash waiting. Christian Schrag, Milford, Nebr.

SEND US YOUR OWN AD TODAY!

For over two years now, the Sprague Trading Post has been helping radio men get the materials they need or dispose of radio materials they do not need. Literally thousands of transactions have been made through this service. Hundreds of servicemen have expressed their sincere appreciation of the help thus rendered.

Send your own ad to us today. Write PLAINLY—hold it to 40 words or less—confine it to radio materials. If acceptable, we'll gladly run it FREE OF CHARGE in the first available issue of one of the five radio magazines wherein the Trading Post appears every month.

HARRY KALKER, Sales Manager

Dept. RN-45, SPRAGUE PRODUCTS CO., North Adams, Mass.

Jobbing Sales Organization for Sprague Electric Company

SPRAGUE CONDENSERS
KOOLOHM RESISTORS

TM. REGISTERED U. S. PATENT OFFICE

Obviously, Sprague cannot assume any responsibility, or guarantee goods, services, etc., which might be exchanged through the above advertisements

YOU

SHOULD KNOW

...the advantages of buying from a Complete Manufacturer, such as SNYDER.

Prompt Delivery
Better Price
Production Control
Maintenance of high Standards

When permissible SNYDER will be first.

ANTENNAE
by
SNYDER
MANUFACTURING CO. • PHILADELPHIA

COMPLETE MANUFACTURERS
FROM START TO FINISH

TECHNICAL BOOK & BULLETIN REVIEW

"RADIO ADVERTISING FOR RETAILERS," by C. H. Sandage. Published by *Harvard University Press*, Cambridge, Massachusetts. 271 pages. Price $4.00.

This book is a compilation of material which Prof. Sandage has collected on the subject of radio advertising. This study was made under the auspices of the Harvard Business School through funds allocated for that purpose by the Columbia Broadcasting System.

This report is written factually and seemingly without bias. Prof. Sandage has made a fair sampling of the retail firms using radio as an advertising media, and he has presented the results in terms of dollar and cents sales, increased public acceptance of the seller's products, and that business intangible, good-will.

Where the retailer has cut his radio budget or dropped all form of radio advertising, the reasons for this move are analyzed on the basis of reports made by the retailer. While Prof. Sandage points out that there are many types of retail establishments who cannot profit from radio advertising, there are many other firms who could use radio profitably.

Many valuable and informative charts and tables have been included for a quick and clear analysis of various factors affecting the use of radio. This book should prove to be of value to all retail establishments, small or large, who have used radio, are planning to use radio, or are, at the present time, "on the air" with their products.

"RADIO PRODUCTION DIRECTING," by Albert R. Crews. Published by *Houghton Mifflin Company*, Boston, Massachusetts. 527 pages. Price $3.60.

While this book is written as a classroom text for use in college courses in radio production, it will give the reader a comprehensive "behind the microphone" view of radio programming. The average radio listener has little comprehension of the amount of time and effort that goes into the preparation of his favorite radio production, whether that program emanates from one of the network studios in New York or from the local station.

While Mr. Crews' experience as production director of NBC might cause him to overlook the problems of the smaller, independent station, he has successfully avoided an overemphasis of the network angle of the problem as he rightly feels that most of the students who use this text will start their careers with the smaller stations rather than the networks. Mr. Crews has outlined the steps necessary before a national network program can be aired, but has indicated which of these steps would be eliminated or combined under an independent station setup.

Mr. Crews has pointed out that while all the personality traits and experience requirements necessary for the "perfect" production director cannot be found in one person, there are many things that the student who wishes to go into this field can do to further his ambition.

This book is a "must" for persons who want to go into the broadcasting production field or operate a broadcasting station. The author has "pulled no punches" as to the difficulty of the task, but concludes that it is a pretty satisfying business to be in, after all.

"AN INTRODUCTION TO ELECTRONICS," by Ralph G. Hudson. Published by *The Macmillan Company*, New York. 92 pages. Price $3.00.

So avid is the public's interest in electronics that Prof. Ralph G. Hudson of the electrical engineering staff of Massachusetts Institute of Technology has prepared a text covering the basic principles of the science.

This book is definitely an adult book, although Mr. Hudson has presented the subject without resorting to the use of mathematics, or reference to physics. This presentation represents a triumph for the author, inasmuch as simplified explanations of complex subjects must, of necessity, be the work of a person with a wide knowledge in his field.

Prof. Hudson has divided his book into seven chapters dealing with the constitution of matter, the flow of electricity, radio communication, reproduction of sound and picture, modern sources of light, rectifiers and applications of electronics. Because the book is limited to 92 pages, it is obvious that the subject is not covered comprehensively, but in its role as an introduction to the subject, it performs its duty admirably.

"DICTIONARY OF ENGINEERING AND MACHINE SHOP TERMS," by A. H. Sandy. Published by *Chemical Publishing Company, Inc.*, Brooklyn, N. Y. 153 pages. Price $2.75.

This is the first American edition of Mr. Sandy's book, which was originally published in England. As Mr. Sandy explains in his foreword, it is often desirable for a newcomer to the engineering field to have access to a sourcebook of commonly used terms.

Mr. Sandy has done an admirable job of making terms clear and understandable. The book has been revised by Dr. I. E. Berck in order that the terms and definitions conform to American idiom rather than English terminology.

The dictionary is recommended not only to engineers and students of engineering, but to the great body of supervisory personnel in industry.

—30—

MAKE MORE MONEY IN Radio TELEVISION & ELECTRONICS Now!

GET THESE 2 BIG BOOKS FREE!

You men already in Radio know how great the demand is for **trained, experienced service men**, operators and technicians. You know how fast the field is growing and how important it is to keep up with developments—F.M. Receivers, Electronics and Television. You know, too, a fellow cannot learn too much about any industry for REAL SUCCESS. Whether you have experience or are merely INTERESTED in radio as an amateur, you must recognize the WONDERFUL OPPORTUNITY right within your grasp to **cash in on your natural abilities.** Make them pay dividends. Get into the EXPERT RADIO SERVICE FIELD. Be an F.M. and TELEVISION specialist — OWN A BUSINESS OF YOUR OWN, if you prefer. Fill out and mail the coupon below for all the details of our plan.

Here's Just a Few of the Interesting Facts You Learn with the FREE MANUAL

1. Routine for diagnosing Radio Troubles.
2. Preliminary Inspection of Receivers.
3. How to Check Power Supply.
4. How to Identify Various Stages of Receiver.
5. How to Trace the Circuit and Prepare Skeleton Diagram.
6. How to Test and Measure Voltages.
7. How to Test Speaker in Audio Stages.
8. How to Test Detector, I.F., R.F., and Mixer Stages.
9. Complete Reference Table for Locating Receiver Troubles.

Get the Latest Inside Information —Short Cuts—Trade Secrets by

SHOP METHOD HOME TRAINING
FROM A REAL ESTABLISHED RESIDENT SCHOOL

Now the famous National Schools brings its exclusive Shop-Method of training right into your own home. You can learn the most up-to-date, approved projects, systems and circuits step by step in **your spare time.** This is the sound practical training you want and need—the development of experienced instructors working with thousands of students right in shops, NEW F.M. broadcast studios and experimental laboratories of NATIONAL SCHOOLS—**one of the most advanced trade educational centers in the world.**

Learn by Doing

Work with Real Experimental Equipment Furnished without Extra Cost as Part of Your National Training

Experience is the best teacher. You learn by experience with the exclusive National Shop-Method of Home Training. In the course of your study you actually build various types of receivers — a powerful superheterodyne, a signal generator, an audio oscillator and others—You make tests and conduct experiments that **show you the why and how of things.** You understand what makes the various elements of electronics operate because you actually see them work for you. Not only do you gain marvelous experience by this method of learning but you receive valuable equipment you will use on the job in the practice of your profession as an electronics expert. **Mail the coupon** and learn what this means to you.

Send the Coupon and prove to yourself what YOU can do in *RADIO!*

National Trained Men Now Making the Best Money in History

The real value of National training shows up on the quick progress our men make on the job. **Incomes that seemed fantastic** only a short time ago are now being reported by National graduates. And this is only a sample of **what the future holds** for the MAN WHO KNOWS RADIO, ELECTRONICS, F.M., TELEVISION and allied subjects. National is proud of the progress its graduates are making all over the world. Read the facts—the actual proof in the books we send you FREE.

Be Sure of Your Success and Security After the War

Don't let your post-war ambitions lag. Don't let YOUR future depend on others. **Build a career for yourself.** Never in all history has the returning serviceman, or war worker been confronted with such a great future if he reaches out and grasps it NOW. Here is a new world opening before you. Get ready now while you are still in uniform—while you are on your war job. Then you can soon step into an essential, well paid position or, **with little capital,** GET INTO BUSINESS FOR YOURSELF. It isn't a bit too soon to start now. Radio men are vitally needed. Fill out and mail the coupon immediately and examine the NATIONAL SHOP METHOD HOME TRAINING COURSE carefully, without obligation.

FREE LESSON INCLUDED

Examine the exclusive National Shop Method of Home Training. See for yourself how sound and practical it is. Be convinced that **you can learn Radio, Electronics, Television**—quickly and easily in your spare time. You can't tell until you try. This trial is ABSOLUTELY FREE. Fill out the coupon immediately while you are thinking about it **and drop it in** the mail at once.

Mail the coupon here for the books that tell you the complete story of the marvelous new system of training in Radio, Electronics and Television. Learn the facts of this exclusive shop-method of home training. **See for yourself!** DECIDE FOR YOURSELF!

This is the MODERN SYSTEM OF TRAINING; it matches the rapid progress constantly being made in Radio, Television and Electronics. It is TIME TESTED, too. National Schools has been training men for more than a third of a century. **It is the very same training that has helped thousands to more pay and greater opportunity.**

You owe it to yourself — your future—to read the book "Your Future in Radio, Electronics and Television"—FREE to you when you send in the coupon.

NATIONAL SCHOOLS

LOS ANGELES 37, CALIFORNIA EST. 1905

MAIL OPPORTUNITY COUPON FOR QUICK ACTION

National Schools, Dept. 4-RN,
4000 South Figueroa Street, Los Angeles 37, California.

(Mail in envelope or paste on penny post card)

Mail me FREE the books mentioned in your ad including a sample lesson of your course, without obligation. I understand no salesman will call on me.

NAME..... AGE.....

ADDRESS .....

CITY..... STATE.....

Include your zone number

WHAT'S NEW IN RADIO

New products for military and civilian use.

FLASHING BEACON

Electronic Laboratories has developed a new lightweight, portable flashing beacon for airports.

This unit, originally designed for identification signalling at military airports, produces high-intensity, short-duration, intermittent light flashes. It operates from 110 volts d.c. or a.c. and utilizes a vibrator power supply for converting to 2000 volts d.c. to produce the flashing light. This same equipment has also been designed to operate from 6-, 12-, or 24-volt storage batteries. All connections are made with waterproof plugs, and the carrying case is completely waterproofed. The beacon lamp may be separately mounted on a pole if desired.

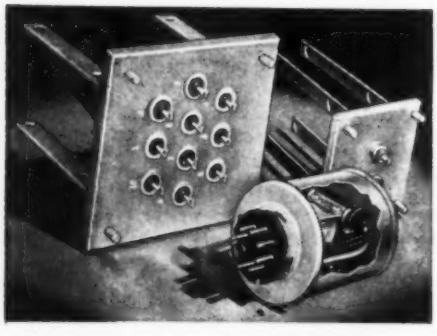
The light is visible, under normal operating conditions, for at least 20 miles at night. Its postwar use is recommended for small airports and as a stand-by beacon for larger airports.

Electronic Laboratories, Inc. of Indianapolis, Indiana, will furnish further details on request.

SEALED HEADERS

The production of all types of sealed headers and sealed mountings for electrical and electronic components is being expedited at *Electronic Testing Laboratories* by means of new manufacturing facilities.

Headers for can-type units can be fabricated with any desired number of hermetically sealed connections. Terminals used are of the glass bead type. These are shockproof and heat resistant and provide a chemically bonded seal between shell and glass as well as between glass and Kovar electrode. The glass is annealed for strain elimination, thus assuring immunity to thermal or mechanical shock. Kovar



electrodes resist corrosion, solder well and are easily welded. Many standard high- and low-voltage terminal types are available for inclusion in the header assembly.

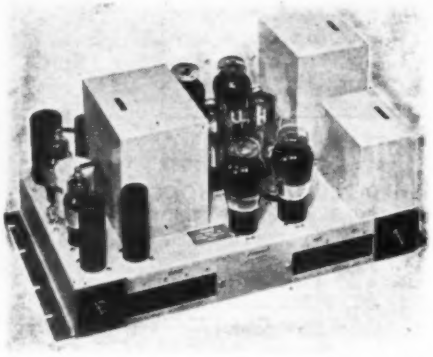
Inquiries are invited and specific problems will be engineered upon request to *Electronic Testing Laboratories, Inc.*, 44 Summer Ave., Newark 4, N. J.

COMMERCIAL AMPLIFIER

The new 101-B commercial amplifier, designed for continuous service over long periods of time, is being announced by the *Langevin Company.*

Excellent waveforms at high levels of low frequencies are provided by an output transformer having a single secondary, thereby improving the efficiency.

A nominal 6-ohm output is provided. The amplifier is intended to feed into a single wide-range loud speaker rep-



resenting an 8/16-ohm load. This unit meets the requirements of excellent music reproduction.

The finish is light gray baked enamel over zinc plating. Dimensions are $18\frac{13}{16}$" over-all length and 12" over-all width.

At the same time the company announced the manufacture of the Type 201-A Wall Mounting Cabinet which permits universal installation of the 101 series amplifiers to any flat surface.

Full details will be furnished upon request to *Langevin Company, Inc.*, 37 West 65th Street, New York, New York.

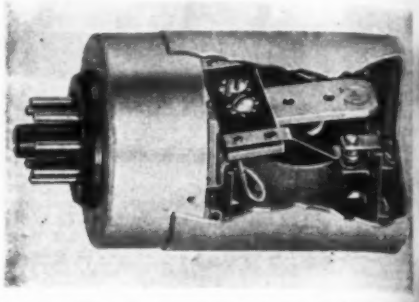
PLUG-IN RELAY

The *Ward Leonard Company* has announced a new relay of the plug-in type, enclosed in a metal can and fitted with a standard octal plug base.

The relay mechanism is encased in a cylindrical metal housing $2\frac{1}{16}$ inch in diameter and $3\frac{1}{8}$ inch high.

The relay is made to operate on standard voltages up to 115 volts, a.c. or d.c. This unit is a modification of a popular type of unit used in small radio transmitters, aircraft control circuits, and similar applications where space is limited. Double-pole, double-throw contacts are rated 4 amperes at 115 volts, 60 cycles a.c., and at 24 volts d.c., ½ ampere from 25 to 115 volts d.c.

Further information about these re-



lays will be forwarded to interested persons upon request to *Ward Leonard Electric Company*, 47 South Street, Mount Vernon, N. Y.

NEW SPEAKERS

A complete new line of loudspeakers is being announced by *Permoflux Corporation* of Chicago.

The speakers which are engineered to cover the entire size range from 2" to 15" are true dimensioned and the diaphragms are graduated in ½" steps up to and including 7½" units, with other standard sizes up to 15".

This line will provide power handling capacities from 1 to 20 watts and will give an acoustical output in 2-db. steps. A new magnetic alloy which provides a magnetic efficiency of at least three times that of prewar-type magnets, results in a considerable saving in weight.

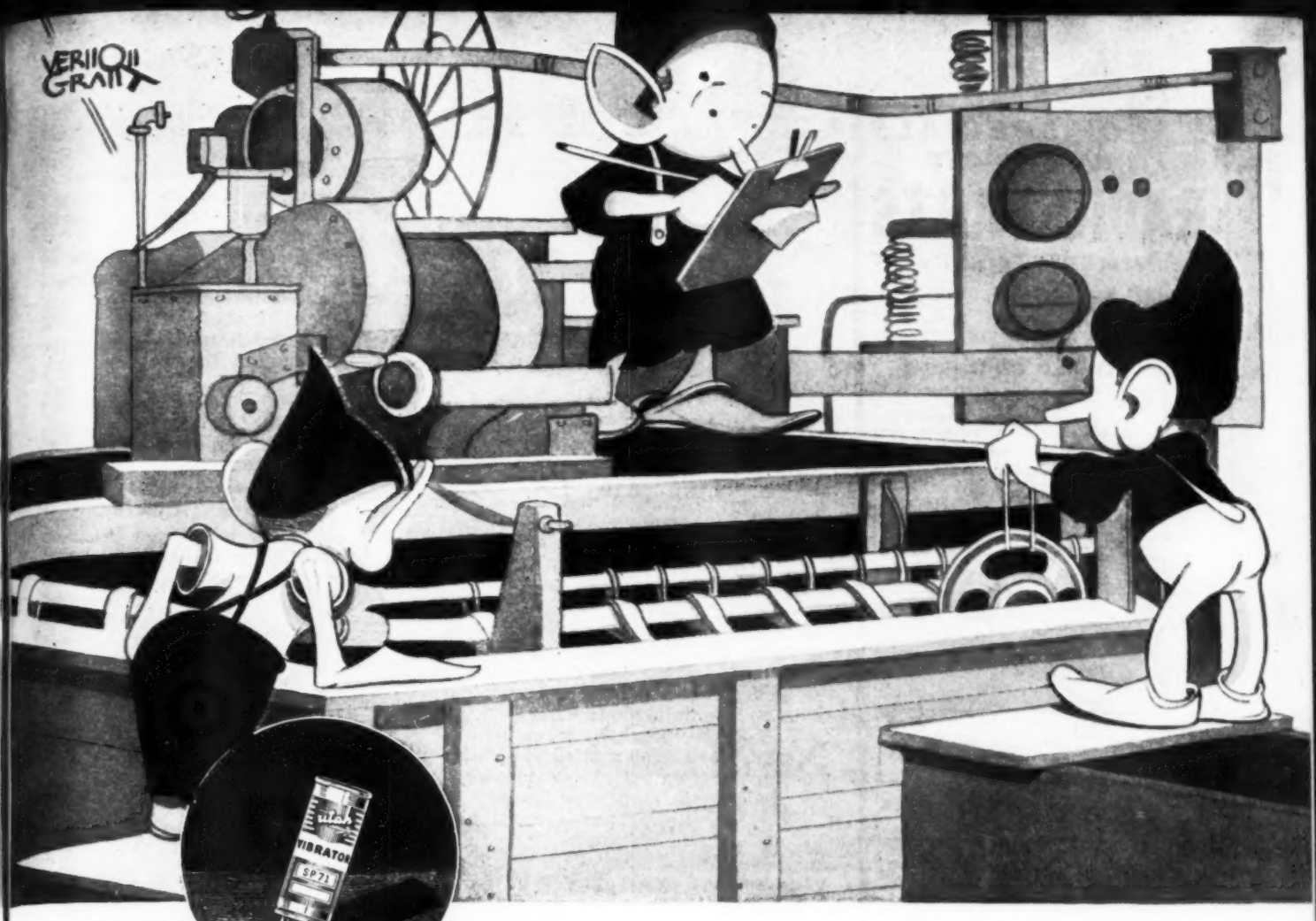
All speakers are completely dust-

proof with all metal parts rustproof finished.

The Permoflux Corporation, 4900 W. Grand Avenue, Chicago 39, Illinois, will forward details upon request.

MEMORY RELAY

A new line of sturdily constructed units for aviation specification have been added to the series of *Struthers-Dunn* products.



**Every Utah vibrator makes and breaks more than a billion contacts during its lifetime.*

PERFORMANCE—THE PROOF OF UTAH QUALITY

You take for granted the plating process in the manufacture of Utah's radio parts and electronic devices. Just as you would take for granted the Utah loud speakers in manufacturers' sets.

But Utalins* don't. They work on this phase of production as carefully as if they were plating with gold. They know that plating is one of the more important steps in the production of these products of precise manufacture . . . of proven performance. Products that stand up under every condition known to man.

Utalins* begin with nothing but raw materials. As each step follows in the process of manufacture . . . tool making, welding, punch press, electroplating, and all the other steps . . . it's checked, re-checked, tested, supervised. Finally the finished products, shipped from Utah's self-contained factory, prove the Utah method correct. For they speak by performance.

utah
RADIO PRODUCTS COMPANY
CHICAGO, ILLINOIS

UTAH RADIO PRODUCTS COMPANY
820 Orleans Street, Chicago 10, Illinois

Utah Electronics (Canada) Ltd., 300 Chambly Rd., Longueuil, Montreal (23) P.Q. • Ucoa Radio, S. A., Misiones 48, Buenos Aires

**Utah's helpers.*

MARCH SPECIALS
of HARD-TO-GET

RADIO PARTS

for *IMMEDIATE* delivery

National Electronic can supply you **immediately** with hundreds of hard-to-get radio parts at exceptional prices . . . some listed below. Take advantage of these savings by ordering from this list today.

LIMITED OFFER

Dry battery eliminator for farm sets. Will deliver up to 112 v of B and up to 2 v of A from any 6 v storage battery. In handsome black metal container . . . complete with cables, etc. Extra Special while they last, $15.95 each.

TUBE SPECIALS

Only these types available, while they last, do not ask for others. All fully guaranteed.
Types UX200A—31—27 .....39c each
Types—39—6SN7GT—55 .....49c each
Types—6SL7GT—6Z5—6Y6—1T4—
3S4—1L4 .....59c each
Types—7H7—22 .....69c each

6 ft. Electric Cord Sets, high grade, soldered, molded, rubber plug at one end, stripped and tinned at other.
Each 29c; 10 for $2.75; 100 for $24.60

3,000 m.f.d. at 3 v F.P. Condenser in aluminum can 1⅝ D x 2 1/16 H. Fresh stock. Special, while they last. Each while they last.....$1.39; 10 for $11.99

A superior Mike Cable, single conductor, shielded and pre-war natural rubber cover.
13c per ft.; 100 ft. $9.90
Dual conductor and shield as above.
18c per ft.; 100 feet for $15.95

CONTINENTAL CARBON RESISTOR KIT No. C6 Assortment. 100 RMA coated ½ and 1 Watt resistors (⅔'s are one watt). Unusual bargain at.....$3.35

AERIAL KIT containing aerial wire, rubber coated lead-in, insulators, ground clamp, window strip, etc. .....each 89c

20 MFD 150 WV Tubular Pigtail Electrolytic. One year guar.....35c; 10 for $3.30

10 MFD 450 WV Tubular Pigtail Electrolytic. One year guar.....43c; 10 for $3.95

Deluxe assortment of 50 Bakelite Set Screw Knobs for ¼" Shaft.....Kit $4.19

50 MFD 150 WV Tubular Pigtail Electrolytic. One year guar.....49c; 10 for $4.45

Heavy Duty GE Pyranol 10 MFD 600 WV (900Pk) Oil filled paper filter condenser in Hermetically Sealed metal container 3" x 4½" x 1" with connections brought through ceramic bushings. List $9.80.
Our price $3.30; 10 for $29.50

Assortment of 200 pcs. Special Radio Hardware including Tube Sockets, Terminal Strips, Grid Caps and Plugs.....Kit $1.49

20x20/150WV Tubular Electrolytic. First Line Condenser. One year guarantee.
Each 61c; 10 for $5.60

HI-TEMP RUBBER PUSH BACK WIRE—Solid and Stranded (#20).
100 ft. roll, 71c; 10 for $6.50

OUTSTANDING OFFER

An assortment of 20 high grade Vitreous Enameled Wire Wound Resistors in 5, 10 & 25 W sizes ranging from 30 to 30,000 Ohms. Selected as to popular usage. Ohmite, Electrohm, Sprague, Utah, etc. Kit # E77. List price $9.60.
Your cost is only..... **$2.99**

LOCTAL SOCKETS—(Metal Supporting Ring).
10 for $1.10; 100 for $9.99

10 MFD 50 WV Tubular Pigtail Electrolytic Condensers. One year guarantee.
Each 28c; 10 for $2.45

Chicago telephone 1 meg. Midget Vol. Cont. with switch, standard ⅜" bushing, shaft ¼" D. x 1". Audio taper.....Each 45c; 10 for $3.95

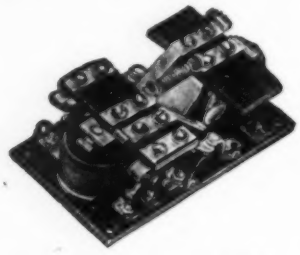
10x10.450WV Tubular Electrolytic. First Line Condenser. One year guarantee.
Each 74c; 10 for $6.90

C.O.D. orders require 20% deposit. We pay all shipping charges only on prepaid orders of $25.00 or more. L-265 or AA-3 certificates are required.

Our FREE bulletin lists many other hard-to-get radio parts and supplies. Ask for it today.

NATIONAL ELECTRONIC SUPPLY
77 W. Washington Blvd. Dept. RN-4
Chicago 2, Ill.

Known as the Series 50XBX, these two-coil relays feature positive interlock between two symmetrical operating elements and represent latch-in



relay construction in a highly simplified form. This latch requires no extraneous parts other than integral extensions of the coil "armatures." It operates postively from a momentary impulse and a minimum of power. Application of power to one coil latches the contacts into one position. Power then applied to the other coil throws the contacts into a latched-in second position. A third "unlatched" position, valuable for certain applications, can be obtained by energizing both coils simultaneously.

Make-before-break, or break-before-make contact combinations are easily obtainable. Contacts do not interrupt the coil circuit until the "throw" is entirely completed and contacts are locked-in the new position.

Relays of this type are produced in ratings from 6 to 200 amperes or more, and with practically any desired contact arrangement. Standard design calls for two auxiliary contacts, one in each coil circuit. The inclusion of auxiliary contacts makes it possible to obtain operation over an extremely wide range of a.c. or d.c. voltages.

Full details will be forwarded upon request to *Struthers-Dunn, Inc.*, 1321 Arch Street, Philadelphia 7, Pa.

P.A. SYSTEM

A powerful, all-purpose amplifying system which delivers a full 60 watts of undistorted output is being featured by *Allied Radio Corporation.*

This unit is of particular value where a wide area is to be covered by a single unit, such as recordings in industrial plants, Army barracks and fields, school stadiums, railroad depots and yards, airport and bus terminals, and for large office paging. The amplifier includes such features as: four individually-controlled microphone channels, two individually-controlled phono channels, universal output for matching any arrangement of speakers, individual controls for high and low frequencies and optional phono top.

The amplifier is available separately or with any combination of speakers and microphones, depending on individual requirements.

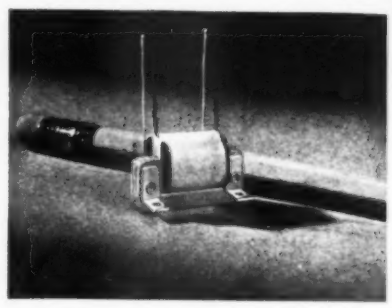
Prompt deliveries can be made on all orders which carry a minimum priority rating of AA5, approved on a WPB-541 application. Local WPB officials are now authorized to approve these applications for war or essential civilian use.

Complete information will be furnished by *Allied Radio Corporation*, 833 W. Jackson Boulevard, Chicago 7, Illinois, upon request.

MIDGET TRANSFORMER

A transformer which can be incorporated directly into the cases of earphones and hand-held microphones because of its small size has been developed by *Permoflux Corporation.*

This unit, whose dimensions are $31/32$" x $37/64$" x $7/16$", has an 80 to 90% operating efficiency with a uniform frequency response of ± 2 db. from 100 to 8,000 cycles. These transformers can be furnished with windings to provide impedances as high as 200,000 ohms and, when used as a choke coil, with inductive reactance as high as



one megohm. They may be potted, shielded, or hermetically sealed, if desired.

Complete information on this unit will be furnished upon request to *Permoflux Corporation*, 4900 W. Grand Avenue, Chicago 39, Illinois.

RIVET EQUIPMENT

A line of low-priced riveting equipment for use in small radio repair shops is now being offered by the *Cherry Rivet Company.*

For radio repair work, the company recommends the hollow rivet because of its unusual tolerances which do not require exact hole drilling in the material to be riveted. This unit consists of an aluminum stem inserted into the hole and extending above and below the rivet. The top of the stem is notched in such a manner that it fits securely into the specially designed *Cherry* rivet guns. The bottom of the stem has a factory formed head, larger than the rivet shank. In application, the rivet and stem are placed in the material hole, and the stem top is inserted into the gun head. The pulling force of the gun draws the stem against the rivet shank, forcing

IT'S SPRING...

and the Plants are Booming!

NO, *THAT'S NOT A TYPOGRAPHICAL ERROR.* We're not speaking of the agricultural variety of plants. We mean WAR plants—like this one at Eastern—and we mean *booming!*

When the Japs dive-bombed us into war, all America prayed for a quick ending. Yet here is still another Spring—a fourth peace-shattered Spring—and the enemy is still fighting back.

It's a tough war and we at Eastern Amplifier know it! Eastern is all-out for Victory, doing its utmost to help end the conflict before another Spring comes. Eastern-built equipment is helping America's war machines to navigate with certainty—to bomb with accuracy. But we're not stopping there! Eastern engineers are available for consultation on any electronic problem. They are serving *NOW!*

With the advent of peace, we shall turn our skill to the creation of better electronic products for a better America. Meanwhile, on request, let us send you the next of a series of articles on important phases of electronics, prepared by our engineering staff. Ask for Brochure 4-E.

Manufacturer's Representatives — write today for our post-war distribution plan. Please outline your present operations.

Buy MORE War Bonds

EASTERN AMPLIFIER E A N.Y.C.

EASTERN AMPLIFIER CORPORATION

U. S. Reg'n. Applied For

794 East 140th Street • New York 54, N. Y.

There are 3 M's in MURDOCK RADIO PHONES

ALL 3 M's are here . . . Men, Methods, and Material . . . teamed together to produce MURDOCK Radio Phones—the keenest ears in radio reception.

To do one thing and do it supremely well is the job of every MURDOCK craftsman. It's that extra-care and attention in manufacture, assembly and inspection that results in a war-tested Radio Phone of unequalled Dependability.

But back of the men and materials is the engineering "know how" of over 40 years' experience in serving peacetime and war-time America. War-sharpened techniques and exacting methods will continue to make MURDOCK Radio Phones the No. 1 listening favorite when Victory is won.

Find out today how MURDOCK "War-Tested" Radio Phones can fit into your post-war plans.

Write for Catalog:

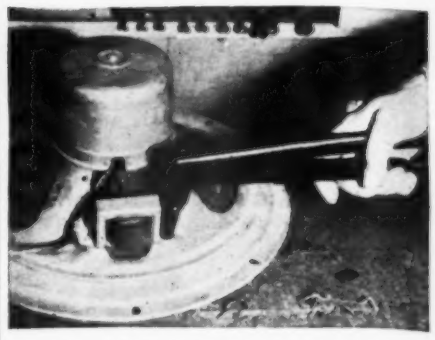
Attention Sub-Contractors

Let MURDOCK ingenuity and experience go to work for you. Though we're busy on government work, we have facilities to help you make more Radio Phones and related parts. Write us now.

WM. J. MURDOCK CO.
168 Carter St., Chelsea 50, Mass.

the shank to spread and clinch into the material with a clinching force of from 300 to 600 pounds. The stem breaks into two parts, both parts falling free of the rivet leaving a tightly clinched hollow rivet.

Recommended applications include fastening tube sockets, transformers, name plates, loudspeaker shields, parts to chassis, lid hinges on portables, etc.



Application of the rivets may be made by means of one of the extensive line of rivet guns manufactured by the company in both air-powered and hand-powered types.

The *Cherry Rivet Company*, 231 Winston Street, Los Angeles 13, California will forward complete information on request.

CONDENSER MOUNTINGS

A new line of M-type brackets for the mounting of oil capacitors has been developed by the *Industrial Condenser Corporation* to meet the most severe vibration conditions. The units meet all Army, Navy, and Aircraft specifications.

Oil capacitors may be mounted in either vertical or inverted positions by means of these brackets which are

readily adapted to any industrial application.

The *Industrial Condenser Corporation* has recently moved to a new and larger plant at 3243 North California Avenue, Chicago 18, Illinois. Inquiries regarding these mounting brackets should be addressed to the company at the new location.

—30—

98% HERMETIC PRODUCTION

The need for maximum dependability in transformer products has swung UTC production into high gear on Hermetic designs. Work at our Varick Street plant, for example, is now 98% Hermetic.

May we cooperate with you on design savings for your applications...war or postwar?

Profession— FLIGHT RADIO OFFICER

With the expansion of postwar commercial aviation, many radio operators will turn toward this field for employment. This article presents the qualifications demanded by the airlines.

By RAYMOND LEWIS

A RADIO man with an eye to flying in commercial aviation as a Flight Radio Officer will do well to lay the foundation for his application now. Expansion of international flying is bound to increase the demand for properly trained technical help. Competition for vacancies will be severe. For this reason, those who succeed in entering the aviation field will do so because they understood and prepared in advance to meet the qualifications demanded by the airlines.

Vague and loose terms have been used to describe the crew member responsible for communications and its allied arts. He is known as a radio operator, a radio gunner, a radio navigator, flight operator, or just as a plain radioman. In our vast operations there are flight radio positions which are adequately filled by a man bearing each of those titles. But all of them are a misnomer when applied to the specialist listed on the crew manifest as a Flight Radio Officer (FRO). Those who feel that such a fine distinction in title is improper are not well informed . . . for the difference hardly does justice to the added responsibility of the Flight Radio Officer.

It is not the purpose of this article to discredit any of the men flying today, whatever their capacity or connection with radio. The point that must be put across is the difference between the duties of the FRO and his military counterpart, born of the exigencies of war. With a solid foundation of Army or Navy training, an applicant has an inside track on the postwar airline job. Recognizing that the Flight Radio Officer is a member of a highly skilled profession, not a mere brasspounder, and then intelligently going about the business of meeting the requirements of the profession, is the surest way of breaking into commercial flying after the war.

The minimum license requirement is a Federal Communications Commission second class telegraph license. A first class radiophone license should be obtained at the earliest possible time. It may not be a prerequisite for employment, but holding the phone ticket will add prestige to an application. CAA certification is required before flying as a crew member. This is obtained by the employer after checking out in the necessary qualifications established by agreement between the airline and the CAA. Actual licensing by this body is to be established after the war. However, requirements will be based on the experience of present-day personnel engaged in this type work. It may be expected to follow a pattern conforming in most respects with checkouts now required by the airlines of all FRO's. Passports, visé, and medical clearance may be considered part of the indoctrination in the sense that an applicant must qualify for them in order to fly.

Physical standards vary, but men acceptable to the service Air Corps will have no trouble passing airline medicals. The health of flight personnel is under careful observation at all times. Annual physicals and preflight examinations demand continuing good health in order to fly. Eyesight below standard, or other minor imperfections which may bar a man from piloting, are rarely a detriment to the FRO. The physical excellence of flight men required in the interests of safety makes good health a large factor in keeping an airline position. In order to prevent this fact from being used unfairly, employees are entitled to an impartial hearing before outside medical experts if there is any question of his fitness to fly for reasons of health. On the other hand, every precaution is observed by the airlines in protecting a man from disease while performing duties outside the United States.

Being hired by an airline is not automatic recognization that you are a qualified FRO. Thousands of dollars must be spent on training. It is this very fact which accounts in a large measure for the rigid personnel standards. It is also a large measure of security. In order to protect its outlay in training a man, the airline must plan on the maximum number

Protected by tank, infantrymen advance on Japanese position. Military radio operators are expected to fill gap in postwar commercial aviation employment.

The Most Powerful High-Frequency Tube

200 Kilowatts—developed especially for high-power, high-frequency broadcast and industrial applications.

Into this development has gone all the knowledge and experience of the tube-building art that make the name Federal stand for dependability — a reputation earned by more than 35 years of service in the electronics field.

Federal tubes are built for long life . . . produced with all the care and precision of fine craftsmanship.

Federal always has made better tubes.

FEDERAL TELEPHONE & RADIO — FTR

Federal Telephone and Radio Corporation

AN IT&T ASSOCIATE — Newark 1, N. J.

JAMES KNIGHTS

"Crystal Controlled"

Frequency Standard

IMMEDIATE DELIVERY!

This is the ideal secondary frequency standard to check frequency of oscillators and transmitters, calibrate and align receivers, check frequency of received signals, band edges, etc. Useful many ways in laboratory or factory for making general frequency measurements or as a signal generator to provide frequencies every 10 kilocycles. Can be used in connection with an impedance bridge as a source of alternating voltage to accurately measure inductances, resistances and capacitances at various frequencies. Provides output up to 40 megacycles at 1,000, 100, and 10 kilocycle intervals. Descriptive catalog sheet on request.

Complete Price Only $59.50

BUY MORE WAR BONDS FOR VICTORY

JK CRYSTALS

The JAMES KNIGHTS Co.

SANDWICH, ILLINOIS

CRYSTALS FOR THE CRITICAL

of years of utilization of his services. Progressive salary increases over a period of years are an inducement to employees. Retirement plans, accumulative sick leave, and numerous other benefits offered by the various companies make working conditions in the industry above average.

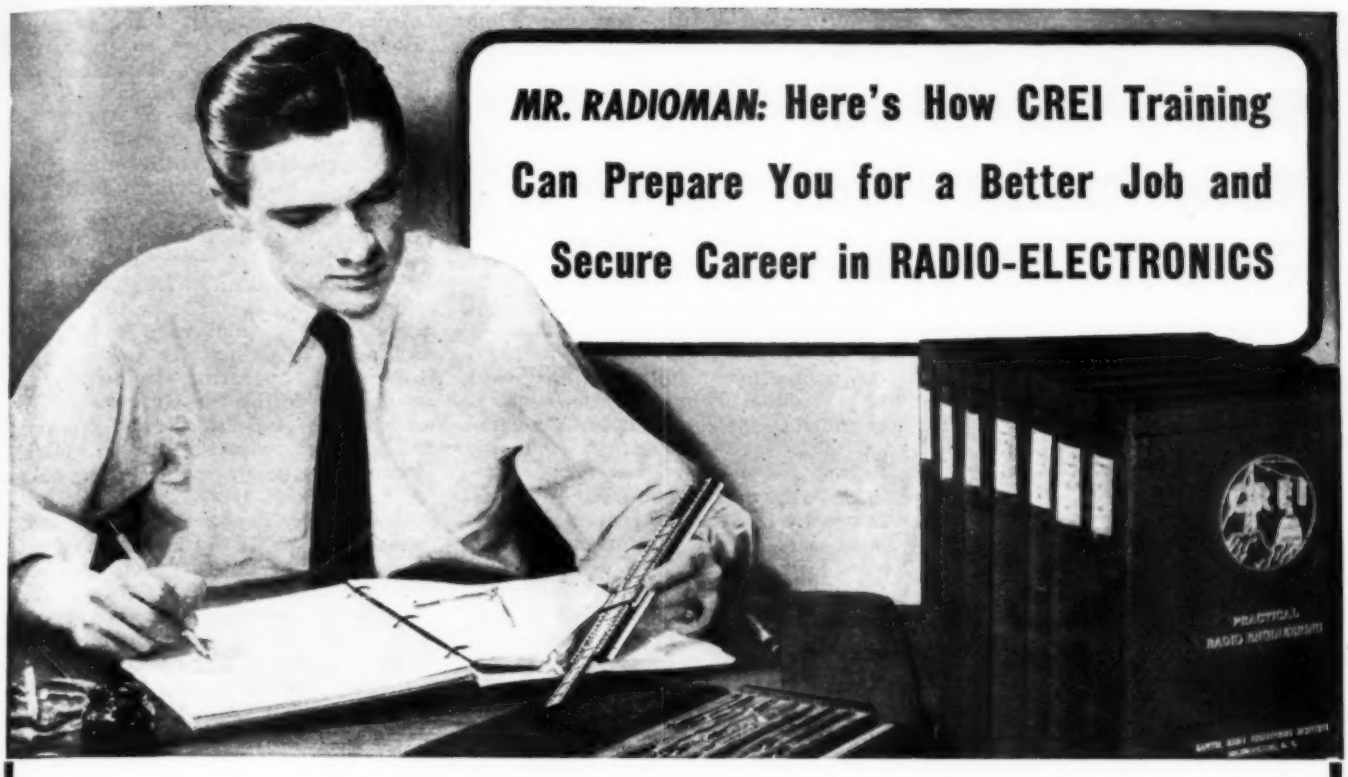
Flight Radio Officers express the fear that wholesale layoffs after the war will become a practice to enable the addition of low-salaried men to the payroll. These men have a distorted sense of value. The very thing that makes an airline a success is the quality of personnel! You can't blame them for being fussy about hiring a man. Once you are in though, they take just as many pains to keep you satisfied. Not in every case has the management-labor relationship been as harmonious as could be desired, but a clash of personalities has been the cause as frequently as legitimate differences of opinion. A probationary period of six months is customary. After that a man is entitled to all the rights of a regular employee.

Technical requirements for a flight position are discussed with much more candor than the labor policies relating to the same work. Very little has been said about this phase of the profession. This is traceable to the reluctance of the airlines to discuss such problems publicly. It may also be attributed to the general conservatism of most FRO's. Until the United States entered the war, there were so few men engaged in this work that the large unions did not actively attempt organization. Several small independent unions did reach agreements with their employers.

The enormous expansion of airline flying has seen both the CIO and AFL start vigorous campaigns for membership. As experienced labor organizations they are demanding far more than asked before. Whether they are successful or not will depend on their own particular leadership. The FRO's have already indicated their unwillingness to stand for anything that degrades the profession. The largest body of men organized today in the field is the independent Flight Radio Officers Association.

The principal grievance was inadequate salary. During the past several years there have been generous increases made in the entire pay structure of the profession. Whether they remain at this level is difficult to foresee. With organized pressure what it is, quite likely there will be no decline in working conditions.

Lest this discussion imply that working conditions were poor, let it be stated for the record that they were not. Management has been unable to deal with individuals as was the case before wartime increases in operating personnel. Written contracts are the natural outgrowth of this condition. After actually assuming flight duties, salaries average two hundred fifty dollars a month. An



MR. RADIOMAN: Here's How CREI Training Can Prepare You for a Better Job and Secure Career in RADIO-ELECTRONICS

CREI Offers A Planned Program of Home Study in Practical Radio-Electronics Engineering That Equips You To Cope With Current and Post-War Technical Problems and Helps to Assure You of a Secure, Profitable Post-War Future

Right now is the time to put your *own* post-war plans in effect! The alert radioman will not wait until post-war technical improvements actually arrive . . . or wait until thousands of new men enter the field . . . before preparing himself with the necessary technical training to assure himself a good job in the post-war fields of Radio-Electronics.

CREI home study courses are constantly being revised and kept up-to-date with the rapid developments in the industry. What do you know today about U.H.F. circuits, cavity resonators, wave guides, Klystrons, Magnetrons and other tubes?

Now is the time to equip yourself with the necessary modern technical knowledge to step ahead of competition into the important, career jobs in radio-electronics engineering. CREI can show you the way by providing the "tools" to build a secure foundation for your future based on our proved method of home study training.

You learn not only *how* . . . but *why!* Easy-to-read and easy-to-understand lessons—each student having his personal instructor—corrections, criticism and suggestions on each lesson examination—these are only a part of the successful CREI method of training for which thousands of professional radiomen have enrolled since 1927.

Your ability to solve tough problems on paper, and then follow up with the necessary practical applications is a true indication that you have gained the *confidence* born of *knowledge* . . . confidence in your ability to get and *hold* an important job with a secure, promising future. These jobs are plentiful today, and will be available tomorrow *for radiomen with up-to-date technical training.*

Investigate CREI home study training now, and prepare for security and happiness in the coming New World of Electronics! *Write for all the facts today.*

Servicemen—
Discharged Veterans

CREI RESIDENCE TRAINING NOW AVAILABLE UNDER PROVISIONS OF "G. I." BILL

CREI now offers Residence School courses in Radio-Electronics Engineering, Broadcast & Television Engineering and Broadcast & Television Servicing under the Serviceman's Readjustment Act of 1944 ("G.I." Bill). Classes now in session. Enter at any time. Write for details.

Those interested in CREI residence school after the war should write for information about the CREI Priority plan.

WRITE TODAY FOR FREE 36-PAGE BOOKLET

"Your Opportunity in the New World of Electronics"

TELL US ALL ABOUT YOURSELF, so that we can intelligently plan a course best suited to your needs. If you have had professional or amateur radio experience—let us prove to you that we have something you need to qualify for a better radio job. To help us intelligently answer your inquiry—PLEASE STATE BRIEFLY YOUR BACKGROUND OF EXPERIENCE, EDUCATION AND PRESENT POSITION.

CAPITOL RADIO Engineering Institute

HOME STUDY COURSES IN PRACTICAL RADIO-ELECTRONICS ENGINEERING FOR PROFESSIONAL SELF-IMPROVEMENT

Dept. RN-4, 3224 — 16th Street, N. W., Washington 10, D. C.

Contractors to U. S. Navy—U. S. Coast Guard—Canadian Broadcasting Corp.
Producers of Well-trained Technical Radiomen for Industry.

IMMEDIATE DELIVERY FROM STOCK

SPRAGUE - CORNELL DUBILIER AEROVOX CONDENSERS

10 mfd 450v Tubular	50¢
16 mfd 450v Tubular	65¢
20 mfd 450v Tubular	70¢
40 mfd 450v Tubular	99¢
20 mfd 150v Tubular	44¢
30 mfd 150v Tubular	47¢
40 mfd 150v Tubular	50¢
20-20 mfd 150v Tubular	76¢
40-20 mfd 150v Tubular	82¢
30-30 mfd 150v Tubular	79¢
50-30 mfd 150v Tubular	94¢
10 mfd 50v Tubular	32¢
25 mfd 25v Tubular	35¢

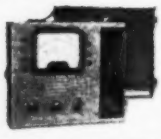
.001 mfd 600v	12¢	.006 mfd	12¢
.002 mfd 600v	12¢	.01 mfd	12¢
.003 mfd 600v	12¢	.02 mfd	12¢
.004 mfd 600v	12¢	.05 mfd	15¢
.005 mfd 600v	12¢	.1 mfd	18¢

TEST EQUIPMENT!!!

Volt- Ohm-Milliammeters

GE UM-3 31.50

Superior PB-100 28.40



Servicemen's Priority

AA-5 MRO CMP5A

Delivery—3 weeks

PM SPEAKERS

4" Square 2 oz.	1.35
5" Round	1.25
6" Round 3.6 oz.	2.10
10" Round 20 oz.	7.20
12" Round 11 oz.	5.19
12" Round 31 oz.	10.14

TURNER MICROPHONES

Model	Type	Cord	List	Your Cost
BX	Crystal	7'	$9.95	$5.85
22X	Crystal	7'	18.50	10.88
33X	Crystal	20'	22.50	13.23
BD	Dynamic	7'	14.50	8.53
33D	Dynam.	20'	23.50	13.82

RADIART VIBRATORS

Type	Mallory Equal	Base	Size	Used in	Each
S-1	4-4	4 Prong	1½-3⅛	Universal	$1.35
5300	294	4 Prong	1⅛-3⅛	Universal	2.09
5326P	509P	4 Prong	1⅛-2⅞	Philco	1.76
5334	868	4 Prong	1⅛-3⅛	Delco	2.09
5341M	901M	4 Prong	1⅛-3⅛	Motorola	1.76
5400	248	6 Prong	1⅛-3⅛	Truetone	3.50
5426	716	5 Prong	1⅝-3½	Buick	3.50

ORDER OTHERS BY MAKE AND SET MODEL

TRIMM ACME DELUXE PHONES

2000 OHM 1.50

Cannon-Ball Dixie 1.56

Brush Crystal Phones Type "A" 7.95

ASTATIC CRYSTAL CARTRIDGES

L40....2.35 LP6....4.70 M22....2.94

PHILCO BEAM OF LIGHT

Selenium Cell only, no holder 1.80

AC-DC RESISTANCE CORDS

135-160-180-220-250-290 OHM

Each ..... 48¢ 10 for 4.30

ICA Universal 22-330 ohm ..... 73¢

560 ohm for 3-way Portable ..... 73¢

BALLAST TUBES

K42B K55B L49C L55B 100-79

K49B K55C L49D 100-70 100-77

Each 45¢ 10 for 4.20

Clarostat Universal 23-55A (octal) each 59c

20% deposit required on all C. O. D. orders. Orders of $25.00 or more accompanied by payment in full, will be shipped prepaid. DON'T FORGET L-265 or AA-3 certificate.

RADIO SUPPLY & ENGINEERING CO., Inc.

129 SELDEN AVE. DETROIT 1, MICH.

intermediate figure for the Flight Radio Officer would be approximately three hundred twenty-five dollars a month. The top available figure paid is four hundred seventy-five dollars a month. Union agreements are calling for an upgrading to a maximum figure of seven hundred dollars, but whether they achieve this goal is problematical. Since there are no bonuses paid for special duty, as in the merchant marine, these figures are all final.

Typical working conditions compiled from available statistics show no marked differences between the various competitive companies. Attempts to stabilize working conditions may be ascribed to the close cooperation which exists in this phase of the industry. Raises and other concessions granted in the contracts signed during the past few years have rarely been made without extensive consultation between men affected. This condition, while healthy in wartime, can produce some equally undesirable conditions by eliminating competition for a man's services.

Normal flight time for a year varies between 900 and 1000 hours. Averaged out over the eleven active flight months, the FRO can anticipate 90 hours a month. Whether flying on a plane carrying one or two Flight Radio Officers, time is logged block to block or dock to dock. Should a man accumulate his time rapidly, ground assignments are usually made for the balance of the year. After each trip there is a certain prescribed rest period based on the length of the trip. During this time a man is free from all assignments. A rough approximation of this can be calculated on the basis of one day off for every ten hours flown. Time off, while outside the United States, does not count in these figures. In addition to this, a thirty day annual leave is prorated on the basis of a full quota of flight time for the year.

While on flight duty outside of the home base, the companies assume all expenses for normal living. Quarters are usually the best available. There are some Flight Radio Officers whose home terminal is outside the continental limits of the U. S. These men receive some sort of a bonus or percentage increase known as a foreign duty allowance. They are in such a minority that their case is unique. Their number is likely to decrease rather than increase because of the rapid nationalization of foreign-operated U. S.-owned airlines.

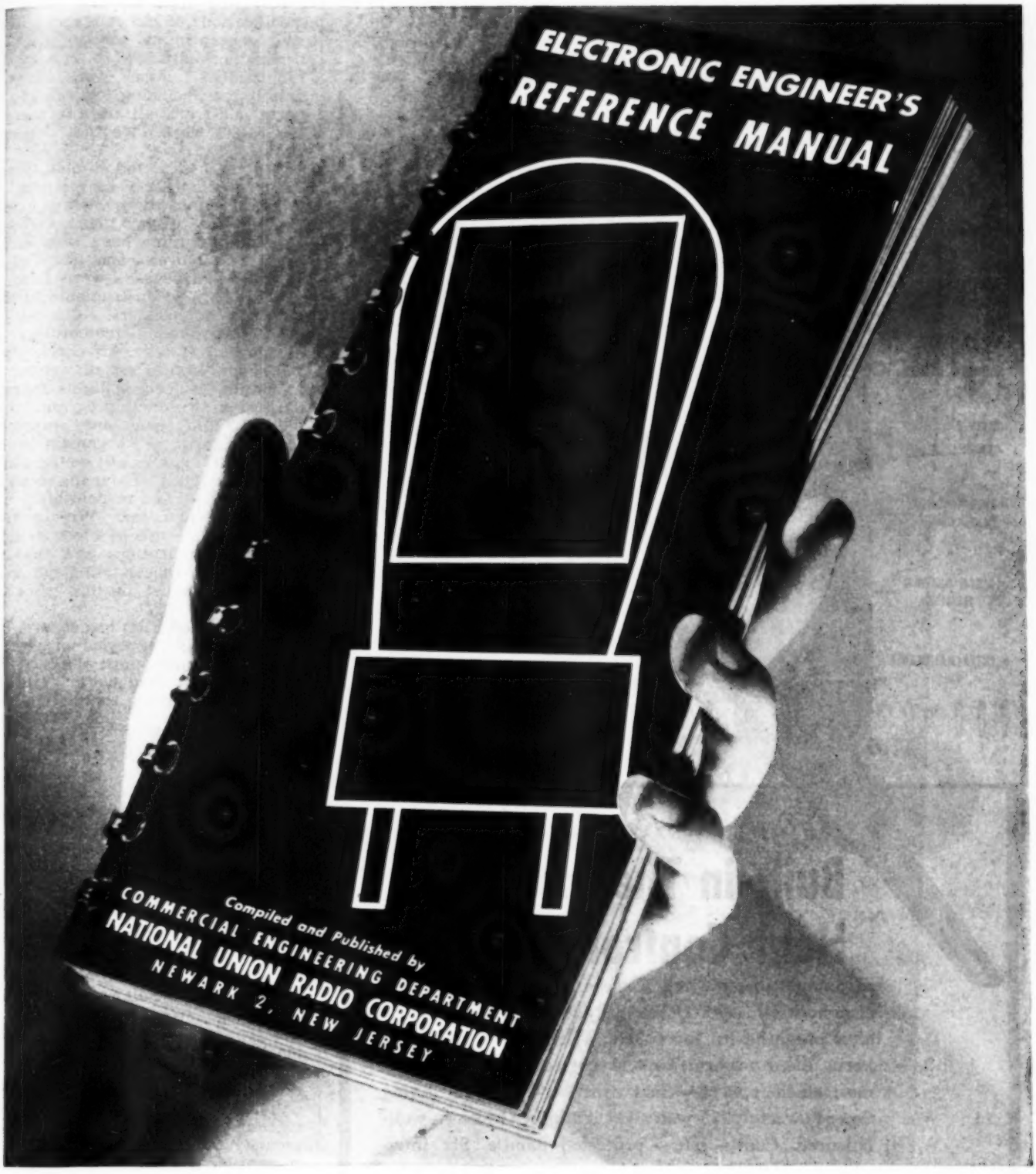
Various grades of proficiency have been established to determine salary. These grades are entered by passing a series of examinations, accruing a certain number of flight hours, and having certain seniority rights. The Flight Radio Officer earns his title only after an intense period of training that covers several years. Unless constant effort is made to stay abreast of new developments this knowledge rapidly becomes obsolete. The FRO's sphere of control on the aircraft is constantly being enlarged. For these reasons this vitally important work has earned its status as a profession with a limitless future.

The specific duties of the Flight Radio Officer vary on different aircraft, as well as with different airlines. The work may be divided into three principal categories: 1) Communications, 2) Navigation, and 3) Electronic aids. Planes are expected to remain in communication with guard stations at all times. It is the duty of the FRO to maintain satisfactory contacts. This entails the selection of proper operating frequencies as well as handling the equipment. Radiophone is largely worked from the cockpit, but responsibility for reliable communications remains in the hands of the FRO.

Radio navigation is an important phase of the FRO duties. Radio bearings using the aircraft loop are taken by the Flight Radio Officer. The automatic direction finder is still only a convenience, as under adverse conditions the manually-operated loop is usually more accurate. Classification of the bearings and the computation are worked out before handing them to the pilot or navigator. While range flying is done by the pilots, the FRO is the authority on their reliability. This assumes greater importance outside the U. S. where installations are not as reliable. Radio is still the secondary tool of navigation, but it is in this field that the greatest advances may be expected after the war. When flying in an overcast, or using radio direction finding as the primary navigation instrument, the FRO is the authority on decisions based upon radio information.

Servicing in flight is an added responsibility for the radio officer. Whenever equipment becomes inoperative every effort must be made to repair it immediately. Complete spares for many operations which can be performed without laboratory equipment are carried. In addition to radio communications equipment, there are such units as the interphone amplifier and direction finders which are the charge of the FRO. Some pieces obviously cannot be serviced beyond tube or fuse changes while in the air. The FRO is expected to be able to determine this. Upon arrival, necessary repairs must be completed or replacements secured. The elaborate Army or Navy system of service echelons does not exist at airline overseas bases. In many small outposts it would not be economically feasible to maintain radio servicing facilities. Even spares might deteriorate from lack of maintenance. The logical solution is to carry a Flight Radio Officer capable of supervising or performing all but the most elaborate repairs himself.

Coherent and detailed technical reports, which are not expected from a radio operator, are part of the FRO's work. Among his flight duties are



JUST OFF THE PRESS!

The new ELECTRONIC ENGINEER'S REFERENCE MANUAL now makes available to the practical engineer all the essential up-to-the-minute facts about electron tubes and related parts. More than 900 types of Receiving, Transmitting, Cathode-Ray and Photo Tubes are described—with physical specifications, characteristics, typical operating conditions, basing diagrams, war-time substitution chart and other data. All this and more in one handy quick-reference book of 146 pages that you can tuck in your pocket. Note ring binding which makes the pages lie flat when book is open. Price $1.00 from your N. U. Distributor. National Union Radio Corporation, Newark 2, New Jersey.

IDEAL FOR RADIO WORK!
KWIKHEAT SOLDERING IRON

IN A CLASS BY ITSELF!
FROM TIP TO PLUG . . .
COMPLETE U.L. APPROVAL
COOL, PROTECTING HANDLE
MODERN DESIGN
WELL BALANCED LIGHT WEIGHT
THERMOSTATIC HEAT CONTROL
QUICK HEATING ELEMENT
6 INTERCHANGEABLE TIPS
0 1 2 3 4 5
★ Weighs only 14 ozs.
★ 225 Watts — Powerful!
★ Heats in only 90 Seconds

Only the Kwikheat has . . .

Built-in Thermostatic Heat Control . . . Check the exclusive advantages that put the Kwikheat Soldering Iron in a class by itself . . . it's *HOT*, ready to use only *90* seconds after plugging in. Saves time. The built-in thermostat keeps the Kwikheat Iron at correct temperature for most efficient work — can't overheat — saves re-tinning time. Powerful, 225 watts, yet it's light (14 oz.) — well-balanced. Cool — safe — protected handle. Six interchangeable tip designs enable one iron to do most jobs. You cannot afford to overlook the Kwikheat Soldering Iron. Write today for complete information — **$11 list.**

VANATTA

Kwikheat

THERMOSTATIC SOLDERING IRON

A Division of
Sound Equipment Corp. of Calif. • 3903 San Fernando Rd., Glendale 4, Calif.

engineering tests on new pieces, or modifications of old equipment. Ability to organize and execute a project demanding initiative is an everyday requirement. Paper work of every description, including logs, charts, reports, and traffic all are a measure of the FRO's work. Neatness is essential!

No one is expected to qualify as a Flight Radio Officer on his own. In order to obtain the necessary qualifications for every man, elaborate training programs have been organized. They cover every phase of the Flight Radio Officer's work from advanced code to instrument landings by radio in trainers. Courses are usually required in meteorology and navigation. Equipment checkouts in the shops, lecture series, written examinations, and check flights are given during the training program. First aid, aldis lamp, emergency equipment, foreign languages, organization history . . . they are all sections in a typical checkout. Even the electrical system is a shared responsibility with the ship's engineers. With a trend towards wider use of electrical control, the implications are that the Flight Radio Officer will have to become a specialist in this associated field.

The qualified FRO has come a long way. Through a period of comparatively low pay until checked out, there is much hard work. The profession entails being away from home for long periods of time. The hours are highly irregular. Flights are often made in unhealthful climates and food is not always up to U. S. standards. The element of risk, while not great, must be considered. When eventually unable to fly, despite the good ground positions which should be open, indications are that a lowering of pay must be expected.

On the other side of the ledger there are these facts to be considered. With new equipment and improved technique, schedules will become more reliable. A more normal home life may be anticipated. Salary scales are still increasing. Working conditions, for the type position, are kept as near ideal as possible. The airlines provide flight crews with the best medical attention obtainable. Hotel accommodations will improve with increased passenger traffic. The position offers security. The work is interesting; the responsibility offers the individual a chance to use personal initiative. Time off from assigned work is sufficient to permit enjoyment of many outside interests.

There will be more applicants than positions for airline openings after the war. The best qualified man will receive first consideration. Preparation for this field can be started today. A selected list of reading material is included at the conclusion of this article. Home-study courses will prove a valuable supplement to men lacking the educational background. While there has been no fixed policy up to

Announcing

12 VIBRATORS MEET 90% OF YOUR REPLACEMENT NEEDS
65 VIBRATORS REPLACE 101 DIFFERENT TYPES

HERE'S real help in your service problems—a new Mallory program of vibrator standardization that cuts red tape . . . eliminates confusion in selecting the proper replacement . . . reduces the number of vibrator types from 101 to 65 . . . yet provides you with the *right* vibrator for practically *every* application!

And here's something better: *fully 90% of your replacement needs can be met by 12 standard Mallory vibrators!* What a time-saving, money-saving convenience that is! It means, among other things, that every service engineer can carry a complete stock in his own shop. It obviously helps in speeding up service.

Yes, vibrator problems are now enormously simplified. AND nothing has been changed in vibrator quality! When you buy a Mallory replacement vibrator you still get a product backed by 14 years of "know-how" . . . made of carefully-selected materials . . . manufactured by precision methods . . . rigidly inspected every step of the way.

Standardize on Mallory vibrators. Ask for your copy of the new Mallory Vibrator Standardization Folder, write your Mallory Distributor.

P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS

RADIO PARTS FOR IMMEDIATE DELIVERY

We carry a complete supply of all types of radio parts and electronic equipment.

TRF HIGH GAIN COILS 65c per set
Ant. and RF Matched Coils

LATE SPECIAL!
MIDGET VARIABLE CONDENSERS
10 to 150 MMF.....69c ea.

DUAL SPACED MIDGET CONDENSERS
7 to 50 MFD.....79c ea.

MICROPHONES

TURNER . . . CRYSTALS

Model	List	Your Cost —Each
BX	$ 9.95	$ 5.85
CX	15.00	8.82
22X	18.50	10.88
33X	21.00	12.35
34X	25.50	14.99
TURNER DYNAMIC HI IMPEDANCE		
22D	$23.50	$13.82
33D	23.50	13.82
99	30.50	17.93
999	33.00	19.41
211	45.00	26.46
ASTATIC		
JT30	$15.50	$ 9.11

(Complete with table stand)
Available with proper Certification.

BALLAST TUBES

K42B	K55B	L42C	100-70	250R
K42C	K55C	L49B	100-77	250R4
K49B	K80B	L49C	100-79	185R
K49C	L42B	L55B		185R8
48c each	10 for $4.50		65c each	10 for $6.15

SPECIAL!
NATIONALLY KNOWN OIL-FILLED CONDENSERS

	List each	Special each	Lots of 10 or more each
2 MFD 1000 volts DC	$6.00	$3.00	$2.75
½ MFD 1500 volts DC	3.30	1.15	1.00

RESISTANCE LINE CORDS

135 ohm	180 ohm	220 ohm	290 ohm
160 ohm	200 ohm	250 ohm	330 ohm
Each.....48c		In Lots of 10.....45c each	
535 ohm, 560 ohm } Each.....69c		In Lots of 10.....65c each	

SPECIAL on MAZDA BULBS

#40 #41 #43 #44 #46 #47 — #51 #55 #13 #14 #222 #233 — #365

Per 10 45c
Per 100 $ 4.00
Per 1000 $37.50

WRITE FOR OUR LATEST CATALOG.
ALL FOREIGN ORDERS PAYABLE IN U. S. FUNDS, F.O.B. CHICAGO.

RADIO PARTS COMPANY
612 W. RANDOLPH ST.
CHICAGO 6, ILLINOIS

now, it is safe to assume that when the airlines are in a position to be very particular among thousands of applications, the better an education, the more likely it will be an asset.

In the final analysis of the future of the FRO, it is necessary to consider the position of the United States in the postwar international aviation field. Prior to our entry into the war there existed a virtual monopoly in U.S. international flying. The multiple crew was organized by this airline and it was they who first realized the importance of the radio officer as a crew member. Competition by domestic airlines has brought with it a tendency to fly with a minimum crew to increase payload. CAA ruling on the number of crew members required for over-ocean flying will determine the demand for Flight Radio Officers. Since the CAA has declared itself in favor of the FRO as an integral part of the crew, his importance may be determined by their licensing requirements. A combined radio-navigator may be used. Since navigation training is far quicker than radio training, the FRO will be the logical choice to assume the additional duties. The number of men used by the airlines is determined by the planes in operation and their utilization factor. Assuming average hourly utilization based on present-day peak performance, four crews per plane are sufficient. This indicates at least several thousand positions available, concurrent with new plane delivery to airlines employing Flight Radio Officers. The most optimistic individual, with unbounded faith in the future of aviation radio, is forced to predict the most intense sort of competition for these available positions.

REFERENCES

Air Navigation — Weems — McGraw-Hill Book Company.

Principles of Aeronautical Radio Engineering — Sandretto — McGraw-Hill Book Company.

Practical Air Navigation — Lyon — CAA Bulletin Number 24.

Radio Direction Finding — Bond — McGraw-Hill Book Company.

Aircraft Navigation Manual — HO No. 216—United States Navy Department.

Aircraft Radio and Electrical Equipment —H. K. Morgan.

—30—

SUPPRESSOR UNIT CAPACITY SELECTOR

By Halstead W. West

THE automobile of tomorrow will bring many new ideas and probably will include radio receivers designed to operate up to 60 megacycles or even higher.

These new radio receivers will require that the automobile electrical system be suppressed for interference to a far greater extent than those of present or prewar makes.

The automobile manufacturer will provide suitable suppression components to eliminate these high-frequency radiations. They have learned a considerable amount in the last few years and of course we will benefit when the new cars again come on the market.

The purpose of this article is to give the reader some ideas on how to apply or improve the suppression equipment on their present cars in case they wish to install one of these ultra-high-frequency receivers.

It has been found that the application of condensers of values as used or applied in suppression in the broadcast band will be found to be ineffective when used in the high-frequency bands. The requirements have to be more definite; one value of condenser that will suppress at a given frequency will not be effective at some other frequency or it will change the interference from one frequency to another.

Choke coils and special condensers designed for suppression of high frequencies, will be available after the war, but even then the job of determining the correct condenser value will be much harder than when suppressing in the broadcast band.

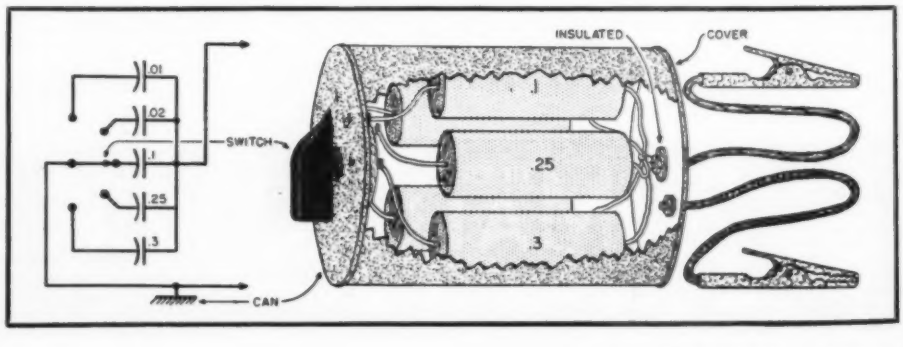
In choosing the correct value of condensers it is a question of cut and try, the condensers must be installed in a permanent manner, not held on by hand or other temporary means, and the condenser lead must be very short; the leads themselves become resonant and will radiate certain frequencies.

Shielding will be helpful in certain cases, such as metal covers over the ignition coils and leads; bolts and nuts on the car should be tight. This will help prevent reradiation; the main thing is to try and keep it under the hood.

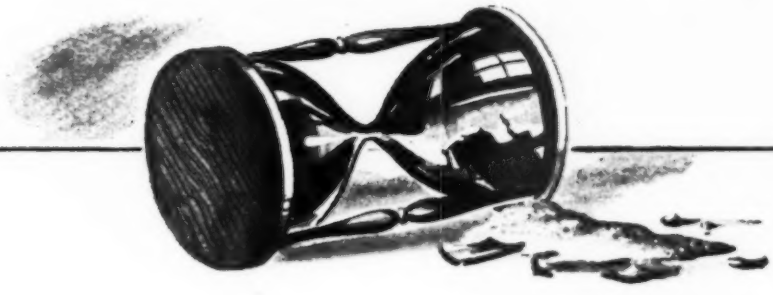
In choosing the proper condenser the device shown in the accompanying sketch will be helpful, and will enable you to rapidly try one value of condenser without removing the unit until it is determined what the ultimate value is needed; then a permanent condenser can be installed.

It will be noticed that the unit position remains constant when using this device and the leads remain the same length. It will be quite valuable to the serviceman or experimenter.

—30—



The lost minute....



Once upon a time in a war plant, there was a man whose diligence was exceeded by none. But, as the headlines became more encouraging, he became casual and, at times, negligent. It was during one of these interludes that he lost a minute. It had escaped unobtrusively, and was gone forever.

But the memory of that minute haunted him day and night . . . so constantly, in fact, that he decided to search for it, to try to reclaim it. And so, in his spare hours, he rode around the world upon a cloud fashioned of thoughts. He tried to trace Time's path through all the countries on the face of the globe.

That was how he happened to be with the Allied assault forces that landed at H-Hour, D-Day on one of the South Pacific islands. He saw how men fighting desperately for a beachhead make each minute count.

That was how he happened to be in an American Field Hospital on the German front when the momentary action of a surgeon saved the life of a GI.

That was how he happened to be in an English village when a buzz-bomb instantly demolished a home.

That was how he happened to see new men born and old men die—all in just one short minute.

After seeing the grotesque, the wonderful, the prosaic things that happen all over the world in one minute—the minute which might have been the one he lost—this man made a resolution.

He resolved that if one minute could be so important to so many people he would fill each of his minutes with sixty seconds, of work—work to help end the war sooner. Never, until peacetime, he vowed, would he again indulge in the luxury of wasting time. . . .

During this war, all of us have lost essential time . . . but not all of us have been as deeply impressed by our loss. Let us call a halt to waste . . . now! Let us stay on the job—geared to an all-out war-time schedule. Let us support all home front activities. Let us give unselfishly of our time, our energy and our money until the world is wrapped in the security of permanent peace.

ARHCO RADIO PRODUCTS

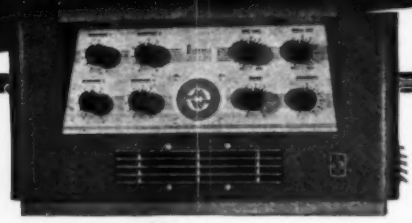
American Radio Hardware Co., Inc.

152 MACQUESTEN PARKWAY SOUTH · MT. VERNON, NEW YORK

MANUFACTURERS OF SHORT WAVE · TELEVISION · RADIO · SOUND EQUIPMENT

ANSWER THE RED CROSS ROLL CALL WITH YOUR DOLLARS

SOUND VALUES at TERMINAL RADIO



Deluxe 30-watt power amplifier

Six input channels — 4 microphone; 2 phonograph

Controls — 4 microphone gain; 1 dual phono gain; 1 master gain; 1 treble cut & boost; 1 bass cut & boost

Double tone control for finest equalization

Wide range, hum and distortion free response

4 — 8 ohm speaker sockets with switch to select speakers and proper impedances simultaneously

500 ohm terminal strip for multiple speaker systems

Gray wrinkle steel case with handles and hinged top
Size 20 x 10⅜ x 10½, for 105-125V 60 cycles AC

Tubes — 6-6SQ7; 1-6SJ7; 2-6L6G; 1-5Z3

MODEL 6729 — PRICE $57.15 NET WITH TUBES. F.O.B. N. Y.

in Stock!

UTAH PUBLIC ADDRESS SPEAKERS

Model	Size	Voice Coil Impedance	Normal Power	Peak Power	Magnet Weight	Price F.O.B.N.Y.
8P	8"	6-8	7	11	5 oz.	$ 3.38
10P	10"	6-8	9	14	12 oz.	$ 5.44
E12P	12"	6-8	13	20	12 oz.	$ 9.41
G12P	12"	8	17	26	46 oz.	$14.26

Terminal Has Microphones in Stock!

Shure 55C Unidyne — Acclaimed as the best.
Price, $29.10 — F.O.B. New York

Shure 717B Crystal Economy Hand Microphone
Price, $5.85 — F.O.B. New York

Turner BX Crystal Economy Microphone
Fits all stands
Price, $5.85 — F.O.B. New York

Electro-Voice V-1 Velocity Ribbon Microphone
Finest of its type.
Price, $16.17 — F.O.B. New York

LARGE SELECTION OF OTHER TYPES BY ALL MANUFACTURERS IN STOCK!

Terminal #MS1 Floor Stand

11 lb. 12" diameter base.
Chrome pipe section. Positive locking clutch.
Price, $6.81 — F.O.B. New York

#MS2 Adjustable Table Stand

All chrome — weighted base.
Price, $3.72 — F.O.B. New York

#MS3 Table Stand

Same as MS2, but not adjustable
Price, $2.95 — F.O.B. New York

Terminal Utility Wall Baffles

Heavy plywood construction.
Tan imitation leatherette finish.
For 8-inch speaker — price, $2.00 — F.O.B., N.Y.
For 10-inch speaker — price, $2.80 — F.O.B., N.Y.
For 12-inch speaker — price, $3.20 — F.O.B., N.Y.

● PRIORITY REQUIREMENTS CHANGE DAILY
● WRITE FOR CATALOG ON TERMINAL SOUND SPECIALS
● WRITE US FOR UP-TO-DATE INFORMATION ON THE ITEMS YOU NEED

Terminal Radio Corporation

85 CORTLANDT STREET, NEW YORK 7, N. Y. Telephone WOrth 2-4415

Wired-Radio Intercom

(*Continued from page 44*)

erative circuit is more satisfactory to some experimenters. In one experimental version of the intercommunicator, a shielded 175-kc. beat oscillator coil from the i.f. stage of an old superhet was employed with success.

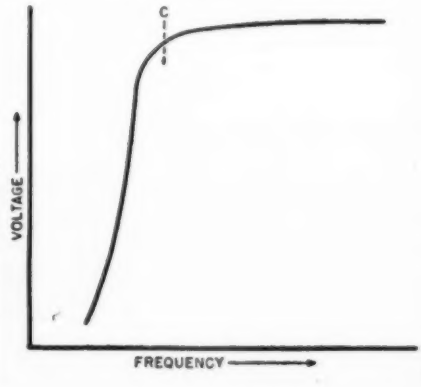
Adjustment

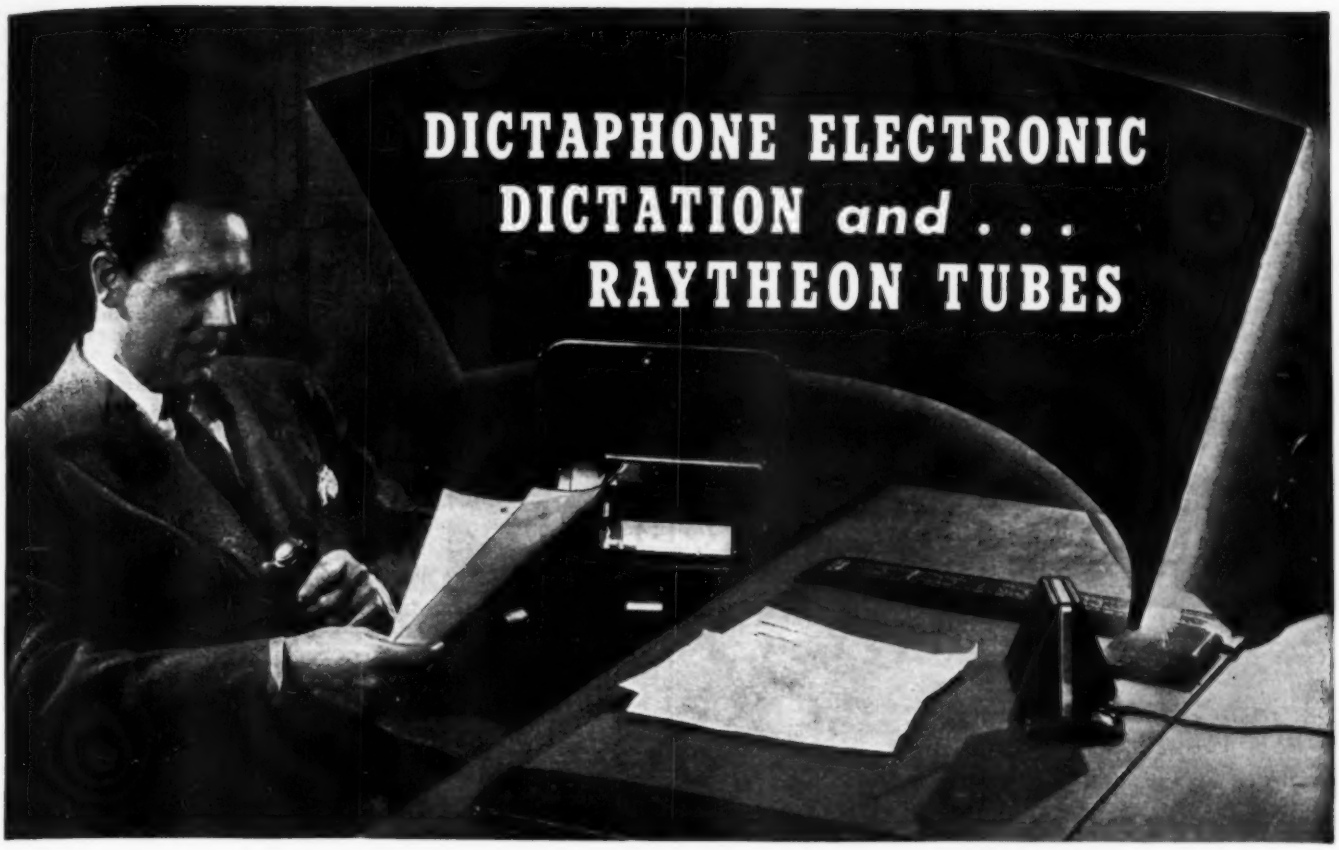
After the wiring has been checked carefully and any corrections made, the intercommunicator may be adjusted in the following manner:

Operating Frequency. (1) Open lead A; (2) Set changeover switch to position R; (3) Set gain control R_6 for maximum volume; (4) Insert line plug into power receptacle and close switch S_3; (5) Connect between points A and B a test oscillator or signal generator tuned to 100 kc. and modulated at 400 cycles; (6) Using the speaker as an indicator, adjust trimmer C_4 for maximum signal strength; (7) Reduce the output of the signal generator, and adjust trimmer C_3 for maximum signal: (8) Shift the position of the slider on resistor R_3 until the circuit no longer oscillates but regenerates mildly, as indicated by a slight "plop" in the speaker when the finger is touched to the grid of V_1 (signal generator disconnected); (9) Fasten slider in this position; (10) It may be necessary during these adjustments to reduce the setting of gain control R_6, in order to prevent overloading of the audio stages; (11) Restore continuity in lead A.

Audio Filter. (1) Open lead C; (2) Set changeover switch to position R; (3) Connect a variable-frequency audio oscillator (set to 300 cycles) between points B and C in the circuit; (4) Insert line plug into power outlet and close switch S_3; (5) Connect high-resistance a.c. voltmeter across input winding of loudspeaker matching transformer; (6) Advance gain control R_6, noting voltmeter reading for the 300-cycle signal, and maintain this R_6 setting throughout the rest of the adjustment; (7) Swing oscillator frequency from about 50 cycles to 1000 cycles, noting variation in voltmeter deflection; (8) Voltmeter readings will

Fig. 6. Ideal high-pass response curve for audio filter. Cutoff point C should be approximately 300 cycles.





● If you're a radio serviceman or engineer, you'll appreciate the ingenuity and development work which produced this new Dictaphone Electronic Dictating Machine which is available for essential uses. And if you're a busy executive, as well, you'll praise it as an aid to getting things done more easily, more quickly and more conveniently. Not only does it record dictation, but over-the-desk conversations and both ends of phone-calls too!

Raytheon high-fidelity tubes used in this remarkable new machine consistently deliver clear, realistic reproduction and give long, dependable performance...just as they will in the future for this and an infinite variety of other electronic devices.

When peace comes, Raytheon tubes will be more readily available. And they'll be even finer than Raytheon's pre-war tubes, for their design and construction will have been proved by the toughest test of all—the acid test of battlefront performance. We can promise, too, if you're a serviceman or dealer, that the Raytheon tube line will be the most *beneficial* line for you to handle. After Victory it will pay you to switch to Raytheon high-fidelity tubes!

• • •

Increased turnover and profits . . . easier stock control . . . better tubes at lower inventory cost . . . These are benefits you will enjoy after the war as a result of the Raytheon standardized tube type program, which is part of our continued planning for the future.

Raytheon
Manufacturing Company
RADIO RECEIVING TUBE DIVISION
Newton, Massachusetts • Los Angeles
New York • Chicago • Atlanta

Listen to
"MEET YOUR NAVY"
Every Saturday Night
ENTIRE BLUE NETWORK
Coast-to-Coast
181 Stations

RAYTHEON
High Fidelity
ELECTRONIC AND RADIO TUBES

All Four Divisions Have Been Awarded
Army-Navy "E" with Stars

yield curve similar to ideal high-pass response curve shown in Fig. 6; (9) Remove trial number of turns from winding of choke L_1, replace latter in circuit, and swing oscillator frequency again above and below 300 cycles, noting new shape of response curve; (10) Repeat operation, adjusting number of turns until cutoff frequency (point C on curve in Fig. 6) is at 300 cycles; (11) Restore continuity in lead C.

Transmitting Position. To test the intercommunicator with its changeover switch in the *transmitting* and *calling* positions, a second identical intercommunicator must first be adjusted, as explained under *Operating Frequency* and *Audio Filter.* Both units then are plugged into the power line.

(1) Plug in each unit so that the lead containing switch S_3 connects to the same side of the power line (it may be necessary to place units in separate rooms to prevent acoustic feedback); (2) Close switch S_3 in each unit; (3) Throw changeover switch in unit under test to position T; (4) Throw changeover switch in monitoring unit to position R; (5) Have assistant talk into speaker of test unit, noting that voice is delivered with more or less fidelity by speaker of monitor unit; (6) If speech is mushy or raspy, adjust gain control R_4 in test unit until overmodulation is relieved; (7) If signal is weak, shift position of slider on resistor R_2 in test unit for stronger signal.

Calling Position. With the two intercommunicator units still plugged into the power line, as explained in the foregoing paragraphs, check the *call* position of the changeover switch in this manner: (1) Throw changeover switch in test unit to position C, noting that audio tone signal issues from speaker of monitor unit; (2) If pitch of signal is not pleasing, adjust value of capacitor C_4 for higher or lower note.

Second Intercommunicator Unit. After all adjustments are made on one intercommunicator unit, it is interchanged with its mate and the same adjustments repeated on the latter.

Operation

The changeover switches in the intercommunicator units are left in the receiving position (R) when the sets are not in actual communication. This places each unit in condition to receive and reproduce the call signal.

"Ringing" the remote intercommunicator unit then may be accomplished simply by throwing the changeover switch of the home unit to position C long enough, by judgment, to attract the attention of the operator of the remote unit. The changeover switch then is returned immediately to the receiving position (R).

The remote operator, having heard the call, throws his changeover switch to the transmitting position (T) and acknowledges the call by talking into his speaker. As soon as he has finished, he then returns his changeover switch to the receiving position (R). The home operator, having heard the acknowledgement, throws his switch to the transmitting position (T) and talks into his speaker to the remote operator.

Some buildings in which carrier-type intercommunicators will be used have 3-wire electric service; 110 volts may be measured between the central (neutral) and each outer conductor. 110-volt service to the various rooms and offices may be taken from opposite sides of the system, so that some outlets are on one side of neutral and some are on the other side. In order to use any wired-radio system on lines of this type, care must be taken that all intercommunicators which are to be in contact with each other are on the *same* side of the system. Units connected in rooms supplied by opposite sides of the power system are not capable of communication unless by radiation, which is undesirable.

Fig. 3 shows diagrammatically the right and wrong ways of connecting wired-radio intercommunicators on three-wire systems.

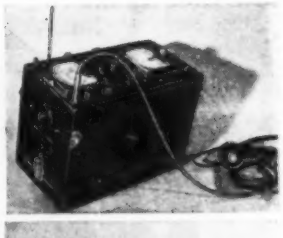
Privacy Filter

A filter, designed to reject the carrier frequency of the intercommunicator system, is effective in securing a

PORTABLE POWER PROBLEMS

THIS MONTH—UNITED AIR LINES' RADIO SIGNAL TEST

DIRECTIONAL INTENSITY of radio signals from all United Air Lines transmitter stations is measured at intervals with portable Field Strength Test Meters, powered by Burgess Industrial Batteries. Control of exact radiation from transmitters maintains perfect communication between ground and flight crews, assuring safe, accurate guidance of planes into airports.



TEST METER records full volt intensity of radio signals, showing how far and in what direction radiation extends from a specific antennae or station. Burgess Industrial Batteries are the standard of quality for commercial uses—they meet every requirement in the operation of test and control instruments. Production of industrial batteries is severely limited today by war needs, and the types you require may not be immediately available. *Burgess Battery Company.*

KEEP YOUR RED CROSS AT HIS SIDE!

BURGESS BATTERIES

EVERYDAY IS WASHDAY AT Triplett

• The special equipment and solutions with which jewels are washed are minor parts of the Triplett method of manufacturing fine electrical measuring instruments but they are significant. They typify the dozens of out-of-sight Extra Precautions that assure your permanent satisfaction with Triplett Instruments. These Extra Care provisions are routine in Triplett plants but through them Triplett maintains in mass production the hand-made quality of fine instruments.

Extra Care in our work puts Extra Value in your Triplett Instrument.

Precision first ...to last

Triplett

STANDARDS ARE SET BY TRIPLETT

ELECTRICAL INSTRUMENT CO. BLUFFTON, OHIO

measure of privacy. This filter, installed in the power line at the main point of entry of the line into the office or building to which communications are to be confined, will prevent the signal from passing over the lines beyond that point.

Fig. 2 shows the circuit arrangement and the constants for such a unit. This is an *m*-type series-derived band-suppression filter which has a mid-frequency of 100 kc. and a bandwidth factor of .5. The circuit has been designed for the very-low impedance presented by the normally loaded power line.

Coil L_1 is in one leg of the power line continuously, consequently must carry the full load current of the office. For that reason, this coil must be wound with a heavy conductor capable of carrying this current safely, and must be adequately ventilated. Coils L_2 and L_3 conduct only a few hundred milliamperes at 60 cycles, but for the sake of safety and reliability these should be wound with conductor not smaller than No. 14 in size. All three coils, as well as the three capacitors, must be well insulated and rigidly mounted. It is advisable to have this filter installed by a licensed electrician with approval of the local electric power company.

The off-standard capacitance values required are obtained by a parallel connection of several conventional capacitors. C_1 consists of .25 μfd., .1 μfd., and .006 μfd. in parallel. C_2 is .02 μfd., .007 μfd., and .00005 μfd. in parallel. And C_3 is .04 μfd., .004 μfd., and .0004 μfd. in parallel. Since these capacitors will work permanently in connection with the power line, they must be of the highest quality and should be chosen for excellent safety factor as regards current-carrying ability and heat dissipation.

—30—

One of a series of Electro-Voice advertisements explaining in detail the applications and specifications of Electro-Voice microphones

. . . a general-purpose dynamic microphone with an exceptionally wide and flat frequency response—for both indoor and outdoor speech and music pick-up —is required . . .

Electro-Voice MODEL 630

This versatile, moderately priced microphone is excellent for public address, all types of dispatching and call systems, paging systems, churches, auditoriums, hotels, recording studios and broadcast remote pick-ups. Though somewhat lighter in weight, it is a sturdy microphone, built with typical Electro-Voice care to serve satisfactorily over a long period of time. Attractively styled, it is finished in lustrous chromium. The Model 630 is unusually flat through lower and middle register, rising 5 db on upper frequencies for added crispness of speech. Operates efficiently in salt air and humidity.

OUTPUT LEVEL: Power ratings: 54 db below 6 milliwatts for 10 bar pressure. Voltage rating (high impedance) 7 db above .001 volt/bar, open circuit. Voltage developed by normal speech (10 bars): .0224 volt.

FREQUENCY RESPONSE: 40-8000 c.p.s., with slightly rising characteristics.

WEIGHT: 1½ pounds.

TILTABLE HEAD: 90° tiltable head for directional or non-directional operation.

CABLE CONNECTOR: Built-in cable connector permits movement of head without moving the cable.

CASE: Built of highest quality, high impact pressure cast metal.

TRANSFORMER CORE: Nickel alloy; hydrogen annealed; low capacity windings.

DIAPHRAGM: Fine quality, heat-treated duralumin; corrosion-inhibited for use in salt air and humidity.

CONDUCTOR CABLE: 20-ft. well shielded cable and connector; low impedance balanced to ground.

HI-Z (DIRECT TO GRID) or 50, 200, 250 and 500 ohms.

SCIENTIFICALLY DESIGNED GRILLE: Reduces wind noise.

ON-OFF SWITCH: Standard ⅝" — 27 stand coupler.

MAGNETIC CIRCUIT: Employs Alnico V and Armco magnetic iron.

List Price, $30.00

Contact your nearest radio parts distributor today. His knowledge of Electro-Voice microphones may aid you in selecting the appropriate type for your individual need. He may also be an important factor in speeding your order.

THE RED CROSS ASKS YOUR HELP . . . GIVE GENEROUSLY

Electro-Voice MICROPHONES

Short-Wave

(*Continued from page* 55)

a.m.-11:30 a.m.; news on the hour; excellent.

JLT3, 15.225, JVU3, 11.897, JZI, 9.535, to North America, 3:15 p.m.-midnight; news on the hour; the 9.535 frequency is heard best at night; excellent.

"Radio Center," Moscow, 15.23, 11.95, 11.88, 7.3, program for North America, 3:48-4:25 p.m.; the CBS correspondent is heard 3:50 p.m. each Monday, Wednesday, and Friday; the NBC correspondent is heard at 4:25 p.m. same days; although announced, frequencies of 11.95 and 7.3 are not heard; news in English, 3:48 p.m.; good.

KIO, 11.68, Honolulu, Hawaii; this station is heard calling "correspondents in the Philippines," 3:30-4:30 p.m.; excellent.

OKLAHOMA—For southwest readers, Don Brewer, Tulsa, Oklahoma, lists the following all-English language programs (EWT):

GSL, 6.11, London, North American Service, 5:15 p.m.-12:45 a.m., with news at 5:45, 6:45, 9, 10:45 p.m. and 12:30 a.m.

CBFX, 9.63, Montreal, Quebec, Canada, 8:30-9:30 a.m. or later, with news at 9 a.m.

HCJB, 12.455 and 9.958, Quito, Ecuador, heard in English from 8 to 9 a.m., 6-7:15 p.m.; news, 6 p.m.

VLC6, 9.615, Shepparton, Australia, 11-11:45 a.m.; news at 11 and 11:35 a.m.

FZI, 11.97 and 9.44, Brazzaville, French Equatorial Africa, 7:25-7:40 p.m.; news, 7:25 p.m.

HP5K, 6.005, Colon, Panama, 11-11:15 p.m. (news).

RNB, 9.783, Leopoldville, Belgian Congo, BBC's North American Service, 9:15 p.m.-12:45 a.m.; news at 10:45 p.m. and 12:30 a.m.

OPL, 9.783, Leopoldville, Belgian Congo, "Belgian Speaks to North America," 8:15-9:15 p.m.; relays BBC, 9:15 p.m.-12:45 a.m.

MIDWEST—Paul H. Massey, River Forest, Illinois, sends us these best bets this month:

HCJB, 12.445 and 9.958, Quito, Ecuador, 2:30-10 p.m., to United States; relays United Network news directly from San Francisco, California at 6 p.m.

FZI, 11.970 and 9.440, Brazzaville, French Equatorial Africa, 12 noon-8:45 p.m.; news in English, 2:45, 4:45, 7:25 p.m.

RNB, 9.783, Leopoldville, Belgian Congo, 8:15 p.m.-12:45 a.m. News at

It will pay you to

SIGN ON THE "DOTTED" LINE!

Yes, Mr. Radio Merchant, for an initial investment of only three cents (for the postage stamp), the way is laid open for you to reap handsome future dividends—post-war and after—through the matchless opportunities provided by the Temple Dealer Franchise. Let us tell you the far-sighted Temple story of assured Profits, of selected, protected Dealerships, of the vital engineering, manufacturing and delivery advantages which YOU, as a Temple Dealer, will enjoy. But don't delay. Fill out the Coupon—and mail today!

TEMPLETONE RADIO MFG. CORP.
New London, Conn.

Gentlemen: As a Dealer of high standing in this community, we would like to obtain, without obligation, full details regarding the Temple Radio Franchise.

NAME X .....

ADDRESS .....

CITY ..... STATE .....

Temple RADIO

FM . . . TELEVISION . . .
RADIO-PHONO' COMBINATIONS

FM F M

Licensed under Armstrong and RCA patents.

8:15, 9:10, 10:45 p.m. and 12:30 a.m.

HEO4, 10.338, Bern, Switzerland, 3:45-4:15 p.m., except Saturday; news at 3:45 p.m.

GSU, 7.26, and GSL, 6.11, London, 5:15 p.m.-12:45 a.m., North American beam; news at 5:45, 6:45, 9, 10:45 p.m. and 12:30 a.m.

OREGON—Robert N. Morris, Portland, Oregon, lists these best bets for beginners in Oregon:

YV5RN, Caracas, Venezuela, 4.920, 9-11:30 p.m.

VE9IA, Edmonton, Alberta, Canada, 6.005, 12-2 a.m.

JZH4, Tokyo, 6.190, 11 a.m.-2:40 p.m.

CKRO, Winnipeg, Manitoba, Canada, 6.150, 6:30 a.m.-12 midnight.

WGEA, Schenectady, New York, 7.00, 8:30-11:30 p.m.

DXJ, Berlin, 7.240, 5:50 p.m.-1 a.m.

DXL25, Berlin, 7.280, 5:50 p.m.-1 a.m.

FZI, Brazzaville, French Equatorial Africa, 9.440, 1 a.m.-2:15 a.m. and 12 noon to 8:45 p.m.

XEWW, Mexico City, 9.50, 9 a.m.-3 a.m. next day.

VLC6, Shepparton, Australia, 9.615, 6-11:45 a.m.

JZI, Tokyo, 9.535, 11 a.m.-2:40 p.m.

FZI, Brazzaville, French Equatorial Africa, 11.970, 12 noon-8:45 p.m.

HCJB, Quito, Ecuador, 12.445, 6:30 a.m.-11 p.m.

RKI, Moscow, 15.110, 6:47-7:25 p.m.

SBT, Stockholm, Sweden, 15.155, 11-11:55 a.m.

GSO, London, 15.180, heard at 2 and 4 p.m.

DJB, Berlin, 15.200, heard at 3 and 5:15 p.m.

JLT3, Tokyo, 15.225, 6:15-7:15 p.m.

VLC4, Shepparton, Australia, 15.315, heard best, 6:45-7:30 p.m.

"Radio Shonan" (Singapore), 15.360, heard 6:45-7:30 p.m.

* * *

REPORTS FROM READERS

GEORGIA—From Macon, Georgia, Robert S. Duggan, Jr., we have the following:

9.650, Deutsche Kurzwellen Sender Atlantik, 5:10 p.m. in parallel with 7.025, 7.42, and 6.212.

15.22, CHA, Sackville, New Brunswick, 9:15 a.m.

10.22, PSH, Rio de Janeiro, Brazil, 7:30 p.m.

18.08, GVO, London, 1:30 p.m.

9.48, ABSIE, 3:30 p.m.

7.21, Dakar, Senegal, 5 p.m.

12.11, HI3X, Ciudad Trujillo, Dominican Republic, 7:30 p.m.

9.9093, ZTJ, Johannesburg, South Africa, off suddenly at 8:45 a.m.

11.78, "Radio Saigon," Indo-China, in English to 7:45 a.m.

15.105, Radio Luxembourg, heard in English, 1:15-1:45 p.m.

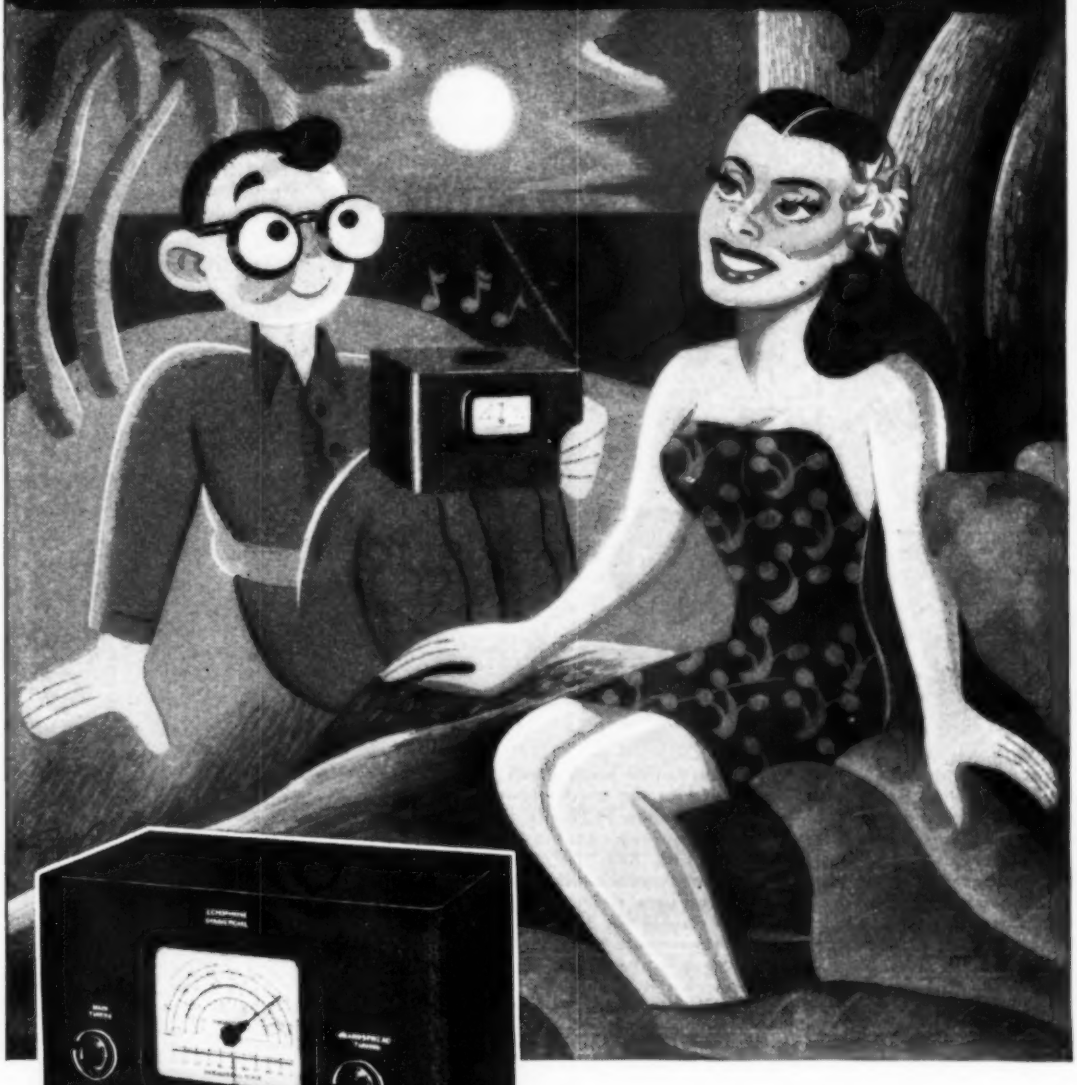
MONTANA—From Glendive, Montana, Emanuel Steinmetz writes that he hears Radio Dakar, Brazzaville, Leopoldville, and other foreign stations each afternoon with good reception, and that Tokyo comes in good on 15.225, 6:15-8:15 p.m. Australia is best mornings over VLC6, 9.615. "I get 'Radio Center,' Moscow, like a local station around 4:45 pm. MST on 15.23 megacycles." All South Americans are good. Chungking comes in fairly well but has a tendency to fade at times.

BRITISH COLUMBIA—From faraway Victoria, British Columbia, Martin Harrison reports:

GWR, 15.30, London, is heard in the General Overseas Service, 12-3 p.m. with a fair to good signal. GSI, 15.26, heard R-9 most days to Africa, 2-3 p.m. GSE, 11.86, comes in R-9 on the Gibraltar beam most days at 12 noon, with news. GWQ, 11.84, is good usually at the same time. GSN, 11.82, is R-8 to R-9 at noon to 3:30 p.m. in African Service; news at 12 p.m. GSD, 11.75, can be heard some days at noon, R-7, badly QRM'd by COCY, Havana, Cuba, which has terrific strength here. GVW, 11.70, is one of the best London frequencies here. It is R-9-plus each day; best at noon with news in African Service. GSG, 11.68, good at noon. GVZ, 9.64, heard at noon or before almost every day. GWO, 9.625, is another R-9-plus station. Heard every day after VLC6 (9.615), Australia, leaves the air at 11:45 a.m. It relays ABSIE, uses the tom-tom identification, beating out V.... GSC is R-9-plus every day; has the news in Persian at 12:30 p.m. in beam to Iraq and Iran. GSB, 9.51, is R-9-plus every day; on Saturdays has the English soccer

What's Going on Here?
The what we can tell you about. The how is one of those many little secrets about instrument manufacture Simpson has learned through more than 35 years of experience. This particular operation has to do with the making of pivots, those critical parts around which the accuracy of any electrical instrument revolves. Only by means of this and other Simpson-developed processes can we make pivots which in strength and hardness, and in their perfect contour, measure up to Simpson's standard.
The Simpson plant is full of such refinements and shortcuts—all aimed at the twin purpose of improving performance and reducing cost. Added to the basic superiority of the patented Simpson movement they provide the fullest measure of accuracy and stamina, and dollar value.
Only Simpson's long familiarity with the problems of instrument manufacture could achieve so many noteworthy solutions. Nothing less can promise so much for the electrical instruments and testing equipment you will use in the years to come.
SIMPSON ELECTRIC CO.
5200-18 W. Kinzie St., Chicago 44, Ill.
Simpson
INSTRUMENTS THAT STAY ACCURATE
MILLIAMPERES

"THERE WASN'T ANYTHING INTERESTING IN THESE ISLANDS UNTIL YOU ARRIVED WITH YOUR ECHOPHONE EC-1"



ECHOPHONE
"The Ears of the World"

ECHOPHONE MODEL EC-1

(Illustrated) a compact communications receiver with every necessary feature for good reception. Covers from 550 kc. to 30 mc. on 3 bands. Electrical bandspread on all bands. Six tubes: Self-contained speaker. 115-125 volts AC or DC.

ECHOPHONE RADIO CO., 540 NORTH MICHIGAN AVE., CHICAGO 11, ILLINOIS

results for the Armed Forces at 3:30 p.m. GRJ, 7.32, carries same program as GSU each morning. GWI, 7.25, good to Armed Forces at 11:30 a.m. on. GRT, BBC European Service, heard at 12:30 p.m. GRN heard recently with news at noon. GSA, 6.05, has language lessons every morning at 11:45 a.m. GRB, 6.01, heard irregularly relaying the BBC's European Service.

DJW, Berlin, 9.65, heard mornings in the African Service; often reads the news at 11:30 a.m.

DJL, 15.11, sometimes heard R-5 in German Home Service or to Germans abroad.

"Radio Nacional de Espana," Spain, heard on 7.205 at 10:30 p.m.

Radio Brazzaville is heard on 11.97 at any time from noon to 7 p.m. and on 9.44 around 3 p.m.

Allied Nations Radio, Algiers, may be heard phoning Rome on 6.04 at noon-12:30 p.m. When there are no messages, records are played. Broadcasts regular programs in the afternoons.

ZRL, South Africa, 9.605, comes in with a weak signal occasionally at 11:30 a.m.

VLC6, 9.615 is by far the best at 11-11:45 a.m. to Western North America; also heard at 10 p.m. to British Isles.

VLC4, 15.315, has a weak but clear signal in the evening, 9:45-10:45 p.m.

Japan is heard R-9-plus on JVA to North America, 11-2:40 a.m. in parallel with 9.535 and 11.725. JLT is strong each day at noon to 2:40 p.m. JAI, 9.535, occasionally heard starting a new transmission at 3 p.m. JVU3 is heard with news at 8:15 p.m. on 11.897 in English; also at 8:45 p.m. has English news. Japan on 15.225 is heard almost every day R-9 at 7 p.m. The 15.16 frequency is heard at 8:15 p.m.

From Siberia, 15.11 and 15.23 are heard irregularly. The 9.565 frequency comes through often at 5 p.m. with Russian songs and woman announcing. There are often long pauses between musical selections, particularly on the quarter hours.

KHE, 17.98, Hawaii, often heard with network relays at any time during the afternoon. KHRO, 6.12, relays San Francisco programs; off the air at noon with announcement in English.

South Americans are too numerous to list fully; best are YV5RN, Caracas, 4.92; YV5RM, Caracas, 4.89; YV6RU, Ciudad de Bolivar, Venezuela, 4.79; HCJB, 9.958, 12.445; XEWW, Mexico City, 9.50; COCY, Havana, 11.74; CXA19, Montevideo, 11.705 at 8:30 p.m.; and COCX, Havana, 9.27.

"Radio Shonan" (Singapore) is now heard on an announced frequency of 15.360 from 6 to 7:30 p.m. Has POW messages.

* * *

WEST COAST REPORT

August Balbi, Los Angeles, sends us the following report:

XGOA, Chungking, 9.73, 7-11 a.m. daily; news, 10 a.m.; weak to fair.

JIE2, Taihuko, Taiwan, 9.69, heard irregularly, 8-9 a.m.; weak signals.

JSL, 9.645, Tokyo, 5-9:45 a.m., in Home Service; also, 6-7:45 p.m.

JLG, 7.285, Tokyo, 5-9:45 a.m., in Home Service, in parallel with JSL.

ZRK, 5.885, Capetown, South Africa, daily, 11:45 p.m.-2:30 a.m.; BBC news relay at 11 p.m.; weak.

ZRL, 9.606, Capetown, South Africa, heard 10-11:30 a.m., Sundays to 12:30 p.m.; much QRM.

"The Voice of Free India," 9.59, heard irregularly, 11-12:30 p.m.; news, 11:30 a.m.

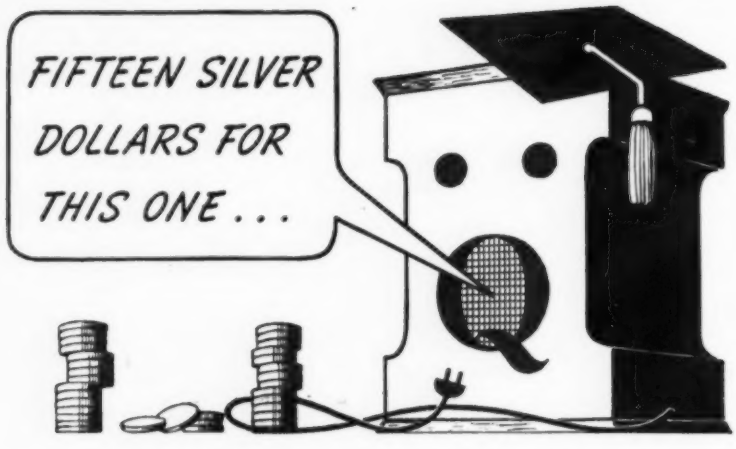
HCJB, 15.115, Quito, Ecuador, heard irregularly to 8 p.m. in parallel with 12.445 and 9.958. (Editor's Note: Only 12.445 and 9.958 frequencies are announced, although the 15.115 transmitter is heard regularly throughout the United States; it is still being used on an experimental basis. The 49-meter band is to be tried shortly by HCJB.)

Dwight Hanson, Tacoma, Washington, reports:

"United Nations Radio, Algiers," is heard on 9.61 and 9.535 during the afternoon relaying the "Voice of America" from New York and the BBC from London; Algiers was formerly heard during the morning on 11.88, but has not been heard there lately. The following tips Mr. Hanson lists in PWT:

CR7BE, 9.71, Lourenco Marques,

RIDER VOLUME XIV COVERS 1941-42 RECEIVERS



"Fifteen silver dollars for this one . . ." were the first words I spoke as a new radio, four years ago. I don't remember the question, but I was thinking of those, my first words the other day when I noticed that that's the price of Rider's Abridged Manual Vols. I to V. It also occurred to me if the "Doctor" had asked "What's the best fifteen dollar investment a radio serviceman can make?" the answer would be easy.

That particular book gives the servicing data on the most widely sold sets issued between 1929 and 1935.

For sets of my age, made in 1941-42, there's Vol. XIV. This gives all the information you need to quickly diagnose and cure defects in we receivers issued during the last year and a half of civilian radio production.

If your jobber's out of a particular volume when you ask for it, please be patient. WPB paper limitations, y'know.

RIDER MANUALS (14 VOLUMES)

Volumes XIV to VII . . 12.50 each volume
Volume VI 9.50
Abridged Manuals I to V (1 vol.) 15.00
Automatic Record Changers and Recorders 7.50

OTHER RIDER BOOKS YOU NEED

The Cathode Ray Tube at Work
Accepted authority on subject 4.00
Frequency Modulation
Gives principles of FM radio 2.00
Servicing by Signal Tracing
Basic Method of radio servicing 4.00
Servicing Superheterodynes 2.00
The Meter at Work
An elementary text on meters 2.00
The Oscillator at Work
How to use, test and repair 2.50
Vacuum Tube Voltmeters
Both theory and practice 2.50
Automatic Frequency Control Systems
—also automatic tuning systems 1.75
A-C Calculation Charts
Two to five times as fast as slide rule . 7.50
Hour-A-Day-with-Rider Series—
On "Alternating Currents in Radio Receivers"—
On "Resonance & Alignment"—
On "Automatic Volume Control"—
On "D-C Voltage Distribution" . . . . 1.25 each

JOHN F. RIDER PUBLISHER, INC. 404 FOURTH AVE., N.Y. 16, N.Y.
Export Division: Rocke-International Corp. 13 E. 40th Street New York City Cable: ARLAB

RIDER MANUALS *are complete* IN 14 VOLUMES

IN ELECTRONICS "*Quality*" HAS A SPECIAL MEANING

AMPHENOL confirms *Quality* BY AFFIDAVIT*

*At Amphenol all U.H.F. Cable is thoroly inspected and must bear affidavit of test approval before shipment.

Extra significance is attached to the whole idea of *Quality* when it applies to electronic equipment. High-frequency currents make special demands of a technical nature that go far beyond the standards of good material and high quality workmanship.

Such requirements are a familiar story to Amphenol, one of the pioneers and leaders in the low-loss transmission equipment field. Amphenol makes the most complete line of both solid dielectric flexible U.H.F. Cables and U.H.F. Connectors and they are now being produced in tremendous volume.

Actually Amphenol's own tests and inspections go beyond required performance and tolerances. Amphenol tests for *outstanding quality* assure dependable performance under the most difficult of conditions.

Amphenol U.H.F. Coax Cables with Amphenol Low-Loss Connectors.

HOW TO TEST A RADIO IN 2 MINUTES OR LESS!

Want to repair radios for neighbors and friends? Or, if you are a radio serviceman, do you want to learn how to diagnose radio troubles and fix sets TWICE AS FAST and TWICE AS PROFITABLY—without a lot of costly, hard-to-get test equipment?

Of course you do—and Ghirardi's RADIO TROUBLE-SHOOTER'S HANDBOOK is just the book that will make it possible for you to do it—for a total cost of only $5. Send coupon on opposite page today.

"IT'S THE BEST OUT OF 20" SAYS CHIEF ENGINEER

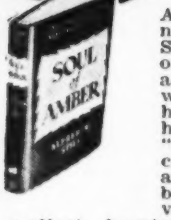
F. S. Bailey, Chief Engineer, Radio Operator's School, Brownsville, Texas, gives this endorsement of Radio-Electronic's greatest basic training book: "We find Ghirardi's RADIO PHYSICS COURSE the best of 20 or more books we have tried . . . both as a complete course in Radio Physics and for all other branches including broadcasting it is giving our students the VERY BEST FOR THEIR MONEY." Order now—use coupon on opposite page!

HOW MUCH Should Good Radio-Electronic Training Cost?

The answer is that the best basic Radio-Electronic Training that money can buy NEED NOT COST YOU MORE THAN $5 **complete.** Ghirardi's RADIO PHYSICS COURSE BOOK (see advertisement on opposite page) is as complete as any book or course AT ANY PRICE—and far more complete than most. It is much easier to learn from—and it is the basic training most widely endorsed by radio experts themselves. Money-back guarantee. You cannot lose! Send coupon TODAY!

The Background of ELECTRICAL SCIENCE

JUST OUT!



THE SOUL OF AMBER, a sparkling new book by Alfred Still will provide hours of pleasurable reading—and acquaint you fully with the entire brilliant history of Electricity in human terms. The "Soul" of amber is, of course, Electricity, and this fascinating book follows its development from its earliest beginning associated with the superstitions of fire dancers. A. A. Ghirardi says . . . "It is the livest, most fascinating and informative story of Electricity I have ever read." 274 pages. Price $2.50. See coupon on opposite page.

Mozambique, now heard from 11:30 a.m. to 1:45 p.m., with news in English at 12:50 p.m.; fair.

SDB2, 10.78, Stockholm, Sweden, came in strong a few mornings, but was bothered by static. It is only heard from 9 to 10 a.m.; poor to good.

SBT, 15.155, Stockholm, Sweden, comes in from 8 to 11:15 a.m.; news in English, 8 a.m.; poor.

"National Congress Radio," 9.59, India, is heard, 9:15-9:45 a.m.; news in English, 9:15 a.m.; fair.

CSW-6, 11.04, Lisbon, Portugal, heard 11 a.m.-3:30 p.m.; comes in best toward end of broadcast; poor to good.

CSW-7, 9.74, Lisbon, Portugal, 6-7 p.m.; (No English from either Lisbon station.) Fair reception.

HEO4, 10.338, Bern, Switzerland, heard 12:45-1:15 p.m., with news in English at 12:45 p.m.; poor. On 7.38, Bern is heard 6:30-8 p.m., with news in English at 6:45 p.m.; poor.

ZNR, 12.115, Aden, Arabia, heard Sundays, 8:45-10:15 a.m.; a woman announces in English at end of their broadcast; no news in English; fair.

"Radio Atlantik," on approximately 6.215, comes in about 5 p.m.; heard signing off at midnight; all speaking is German.

TAP, 9.465, Ankara, Turkey, broadcasts from 8:30 a.m. to 1:45 p.m.; newscast in English is heard at 9:45 a.m.; the Postbag broadcast is heard from approximately 1:30 to 1:45 p.m. on Sundays; poor to fair.

Among the best-heard stations in his area, Robert Morris, Portland, Oregon, lists: DXJ, 7.24, DXG, 6.19, and DXP, 6.03, Berlin, 5:50 p.m.-1 a.m., with news in English on the hour; JZI, 9.535, 11:30 a.m.-1:45 p.m. JZH4, 6.13, with 6.19, sometimes also used, Japan, 11:30 a.m.-2:40 p.m.; JLG, 7.28, 1:30-6:30 p.m. JRAK, 9.56, heard in Home Service only. Hsinking, MTCY, approximately 7.100, heard in Home Service, with news at 10 a.m. "Radio Shonan" (Singapore) is now heard on 15.360 at 8:15 p.m. CBRX, 6.160, Vancouver, British Columbia, heard daily 10:30 a.m. to 2:32 a.m. next day, 150 watts; CKFX, 6.080, 10-watt station in Vancouver is heard 11 a.m.-2 a.m. next day.

JVW, 7.2, Tokyo, heard 9-10:40 a.m., 11 a.m.-2:40 p.m.; fair. Java on 18.135 is weak but readable, 9-10 p.m. The "All India Radio," Delhi, is heard on 15.20, 10:45-11 p.m.; good. (Noyes, Calif.)

"Voice of Pacific Fleet," heard on approximately 7.4, at 1:20 a.m. recently. (DeVan, Calif.)

VLC5, 9.54, Australia, heard at 8:30 a.m. XEWW, 9.5, Mexico City, heard consistently. LRS1, 5.9, Buenos Aires, Argentina, heard each evening to 12:30 a.m. (Woolley, Colorado.)

* * *

EAST COAST REPORT

From North Adams, Mass., Gilbert L. Harris reports:

11.642, Leningrad (Moscow relay), U.S.S.R., heard 10:30 a.m.-12:30 p.m., the sign-off.

11.680, GSG, London, heard at 12:30 p.m. with a program for Turkey.

10.005, "Voice of Free Arabs," heard 3:15-3:27 p.m.

9.465, TAP, Ankara, Turkey, heard Mondays and Thursdays, 4:30-4:45 p.m. with a special beam to Britain.

A station believed to be "Radio Atlantik" was recently heard in German at 3:45 p.m. on 12.420; called, "Achtung Luftwaffe."

5.970, VONH, St. John's, Newfoundland, heard with English news at 5:30 p.m.

7.935, PSL, Rio de Janeiro, Brazil, heard at 7:30 p.m.

8.550, "Radio Tevere," German-occupied Northern Italy, heard signing off at 9 p.m.

9.735, CSW-7, Lisbon, Portugal, heard 9-10 p.m.

12.115, ZNR, Aden, Arabia, heard signing off at 1:17 p.m.

9.615, VLC6, Shepparton, Australia, heard with news in English at 11 and 11:30 a.m. daily.

15.11, DJL, Berlin, heard signing on at 11:20 a.m. to Africa.

(*Continued on page* 148)

Let's Talk Shop

(*Continued from page* 45)

is by no means secure; however, there is no situation so bad that there is not some remedy that cannot be applied. Fundamentally every serviceman who is now operating a service business should prepare himself for the future in the following ways:

First, he should study the new circuits. He should actually go to school in order that he may become acquainted with high-frequency and ultra-high-frequency operations.

Second, he should learn as soon as possible the principles of operation of high-frequency test equipment. He should learn to operate this equipment in order that he will at least start even with the men who have been trained by the government.

Third, he should begin to build his customer relations immediately. His mailing lists should be overhauled, prospects for new customers should be noted, and he should endeavor to the best of his ability to repair and return all receivers that he has standing now in his shop.

He certainly should make an affiliation with a set manufacturer or his jobber in order that he will have radio sets to sell when they are available.

I do not believe that any service business can exist purely as a service but must consist mainly of new sales.

With all kinds of new electronic devices planned for the postwar period the average serviceman can find many lines to add to his operation that do not require too much capital investment. Above all he must become sales minded and unless he is willing to do this and operate his establishment on strictly business lines he is much better off out of the picture.

—30—

MAKE MONEY REPAIRING RADIOS

AND OTHER ELECTRONIC EQUIPMENT

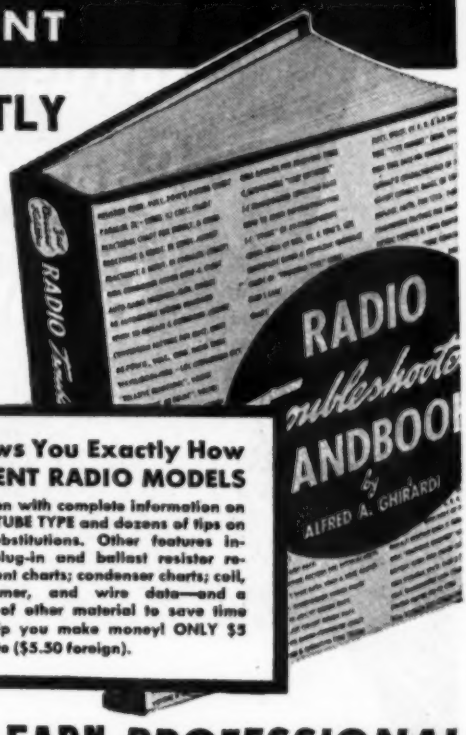
TELLS YOU EXACTLY *WHAT* TO *DO*...EXACTLY HOW TO DO IT

If you like to repair radios at home in spare time, Ghirardi's RADIO TROUBLESHOOTER'S HANDBOOK offers you a new, fast way that makes the work easy—without a lot of previous experience or scarce, expensive test equipment. Or, if you are a professional radio man, it helps you repair two sets in less than the time you'd normally take for one. It is the ideal book for training new helpers, for substituting tubes and parts in these days of shortages, for repairing cheap sets quickly and profitably—in short, for repairing radios better, faster and more profitably than you may have thought possible.

4 LBS. OF FACTUAL, TIME-SAVING MONEY-MAKING SERVICE DATA

RADIO TROUBLESHOOTER'S HANDBOOK isn't a "study" book. It rolls up its sleeves and goes to work for you the minute you get it. It can easily pay for itself the first time you use it! Simply look up the make, model, and the trouble symptom of the Radio you want to repair . . . and go to work. No useless testing! No lost time or motion! The HANDBOOK'S clear instructions tell you exactly what the trouble is likely to be . . . and EXACTLY how to fix it. Actually, thi big 4 pound, 744-page, manual size HANDBOOK brings you factual repair data for practically every radio in use today—over 4,800 individual makes and models!

In addition, there are hundreds of pages of helpful repair charts, tube charts, data on tuning alignment, transformer troubles, tube and parts substitutions, color codes, etc.—all for only $5 ($5.50 foreign) on an ABSOLUTE 5-DAY MONEY-BACK GUARANTEE.

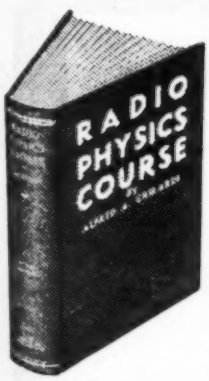


This "Automatic Teacher" Shows You Exactly How to REPAIR OVER 4,800 DIFFERENT RADIO MODELS

Over 400 pages of the RADIO TROUBLESHOOTER'S HANDBOOK include specific common Trouble Symptoms, their Causes and Remedies for practically every Radio Receiver in use today. IN ADDITION, there are hundreds of pages including i-f alignment peaks for over 20,000 superhets; a big data section on i-f transformer troubles—and the most up-to-the-minute TUBE CHART you've ever seen with complete information on EVERY TUBE TYPE and dozens of tips on tube substitutions. Other features include plug-in and ballast resistor replacement charts; condenser charts; coil, transformer, and wire data—and a wealth of other material to save time and help you make money! ONLY $5 complete ($5.50 foreign).

COMPLETE BASIC RADIO-ELECTRONIC TRAINING

FOR BEGINNERS $5



All the Basic Science of Radio-Electronics in One Big 3½ lb. Book—No Monthly lessons to wait for.

($5.50 foreign).

36 COURSES IN ONE

Easily worth $50 or more if broken into "course" form and sent to you in monthly lessons.

Train NOW for the most interesting of all postwar futures—RADIO-ELECTRONICS! Ghirardi's 972-page RADIO PHYSICS COURSE BOOK gives you all the basic training you need—at a price you can afford to pay! Actually, this big book has started more people in Radio-Electronics than any other book or course. It is more widely used for home study—and more widely used in U. S. Signal Corps and Navy Schools and in civilian schools and colleges than any other book of its kind!

NO OTHER COURSE LIKE IT!

Ghirardi's RADIO PHYSICS COURSE book with its 500 illustrations and 856 self-testing review questions makes it surprisingly easy for you to learn at home without an instructor. Nothing is omitted, nothing condensed. Everything is made as easy as A-B-C. Ask any radio man! You'll be amazed how quickly you'll master the subjects that other courses and books make seem very complicated. Begin today. Examine this truly great book for 5 full days—and get every cent of your money back if you're not more than satisfied.

LEARN *PROFESSIONAL* SERVICE WORK AT HOME WITHOUT AN INSTRUCTOR!

Study now for a good job as a professional Radio-Electronic Service Expert. It's easy to learn from Ghirardi's big 1300-page profusely illustrated MODERN RADIO SERVICING book that costs you only $5 complete. This one big book covers all phases of the work! Explains all necessary test instruments . . . even how to build your own if you prefer; how to troubleshoot all makes of radios, analyze electronic circuits, test components, make adjustments, repairs, etc., etc.—all step-by-step. Even explains how to start a successful Radio-Electronic Service Business of your own. Sold separately for $5 ($5.50 foreign), or see MONEY-SAVING COMBINATION OFFER in coupon.

EVERY CONCEIVABLE SERVICE SUBJECT

Explains circuit and operation of all types of essential service instruments: How and when to use them; How to build your own; Preliminary trouble checks; Troubleshooting; Repairs; Obscure radio troubles; Aligning and neutralizing; Auto and Marine Radios; Interference reduction; AVC and QAVC circuits, etc., etc.

5-DAY MONEY BACK GUARANTEE

Technical Division, MURRAY HILL BOOKS, Inc.,
Dept. RN-45, 232 Madison Ave., New York 16, N. Y.

Enclosed find $.....for books checked; or □send C.O.D. (in U. S. A. only) for this amount plus postage. If not fully satisfactory, I may return the books at the end of 5 days and receive my money back.

□ RADIO TROUBLESHOOTER'S HANDBOOK $5 ($5.50 foreign)
□ RADIO PHYSICS COURSE $5 ($5.50 foreign)
□ MODERN RADIO SERVICING $5 ($5.50 foreign)
□ THE SOUL OF AMBER $2.50 ($2.75 foreign)

□ **Special MONEY-SAVING COMBINATION:**
Both Modern Radio Servicing and Troubleshooter's Handbook $9.50 for the two ($10.50 foreign).

Name.....

Address.....

City & Dist. No.....State.....

(Please print or write plainly)

* Hands that Capture the Future . . . .
* FOR THE RADIO OF TOMORROW
War-trained hands . . . fingers educated in accuracy and speed . . guided by new facts wrested from the widening frontiers of electronics research . . . hands that will create unsurpassed values in "Detrola-built" Radio Receivers . . . Television Receivers . . . Automatic Record Changers, and other electronic instruments.
KEEP YOUR EYE ON DETROLA
DETROLA RADIO
DIVISION OF
INTERNATIONAL DETROLA CORPORATION
BEARD AT CHATFIELD • DETROIT 9, MICH.
KEEP ON BUYING AND KEEP THOSE WAR BONDS

Tube Substitutions

(Continued from page 51)

6S7 ..... 6D6[6-3], 6SS7[4], 6SK7[6-4], 6K7[6]
6SA7 ..... 6A7[3], 6A8[4], 6D8[4-2]—42 ohms
6SC7 ..... 7F7[3], 6SL7[4]
6SD7GT ..... 6SG7[4], 6SK7, 6K7[4]
6SE7 ..... 6T6[4-6], 6M7[4], 6SJ7
6SF5 ..... 6F5[4], 6Q7[4], 75[3], 6K5[4]
6SJ7 ..... 6J7[4], 6C6[3], 77[3], 6W7[4-2]—42 ohms
6SK7 ..... 6K7[4], 6SG7[4], 6SS7[2]—42 ohms, 78[3]
6SL7GT ..... 6SC7[4], 7F7[3]
6SN7GT ..... 6F8[4], 7N7[3], 6J6[3-2]—42 ohms, 6C8[4-2]—21 ohms
6SQ7 ..... 6Q7[4], 75[3], 6T7[4-2]—42 ohms, 7B6[3]
6SR7 ..... 6R7[4], 85[3], 6V7[4], 6ST7[2]—42 ohms, 6C7[3], 7E6[3]
6SS7 ..... 6SK7[6], 6K7[6-4], 78[6-3], 6D6[6-3], 6S7[4]
6T5 ..... 6U5/6G5, 6N5[2]—42 ohms
6T6 ..... 7T7[3-2]—42 ohms, 6SE7[4-2]—42 ohms
6T7 ..... 6Q7[6], 7C6[3]
6U5/6G5 ..... 6T5, 6H5, 6N5[2]—42 ohms
6U6GT 6V6
6U7G ..... 6D6[3], 78[3], 6K7, 6SK7[4], 6SS7[4-2]—42 ohms
6V6 ..... 6U6, 7C5[3]
6V7G ..... 85[3]
6W5G ..... 7Z4[3]
6W6GT 6Y6, 6V6
6W7G ..... 6J7[6], 6SJ7[4-6], 7C7[3]
6X5 ..... 0Z4, 7Y4[3-7]
6Y5 ..... 6X5[3], 84/6Z4[3]
6Y6G 6W6, 6V6
6Y7G ..... 79[3], 6Z7[2]—21 ohms
6Z3 ..... 1V, 6ZY5[3]
6Z4 ..... See 84/6Z4
6Z5 ..... 84/6Z4[3-7], 12Z5[3]
6Z7G ..... 6Y7[6], 79[3-6]
6ZY5G ..... 84/6Z4[3-6]
7A4 ..... 6C5[3], 6J5[3], 76[3]
7A5 ..... 6V6[3]
7A6 ..... 6H6[3-6]
7A7 ..... 7H7, 7B7[2]—42 ohms, 78[3]
7A8 ..... 7B8[6], 6SA7[3-6], 6D8[3]
7B4 ..... 6F5[3], 6SF5[3], 6K5[3]
7B5 ..... 6K6[3], 41[3]
7B6 ..... 6Q7[3], 75[3], 6T7[3-2]—42 ohms, 7C6[2]—42 ohms
7B7 ..... 7A7[6], 6SS7[3]
7B8 ..... 7A8[2]—42 ohms, 6SA7[3], 6D8[3-2]—42 ohms
7C5 ..... 6V6[3]
7C6 ..... 6T7[3], 7B6[6]
7C7 ..... 6W7[3], 6J7[6-3]
7D7 ..... 7S7
7E5/1221 ..... 6C6
7E6 ..... 6R7[3], 6SR7[3]
7E7 ..... 6B7[3], 6B8[3]
7F7 ..... 6SC7[3], 6SL7[3]
7G7/1232 ..... 7V7, 6T6[3]
7H7 ..... 6SD7[3], 6SG7[3]
7J7 ..... 6K8[3], 6J8[3]
7K7 ..... 7B6[4], 7C6[4-2]—42 ohms
7L7 ..... 7G7/1232[6], 7T7
7N7 ..... 6SN7[3]
7Q7 ..... 6A7[3], 6A8[3], 6SA7[3]
7R7 ..... 7E7[4], 6B7[3], 6B8[3]
7S7 ..... 7D7[6], 7J7
7T7 ..... 7V7[6], 7G7/1232[6], 6SH7[3]
7V7 ..... 7G7/1232
7W7 ..... 6S6[3], 6SG7[3]
7Y4 ..... 6X5[3], 0Z4[3], 84/6Z4[3-7], 6Z5[3]
7Z4 ..... 7Y4[7], 6X5[3-7], 6W5[3]
12A5 ..... 6F6[6-3]
12A8 ..... 12SA7[4], 6D8[1]—42 ohms
12B6M ..... 12Q7[4], 12SQ7[4]
12B7 ..... See 14A7/12B7
12C8 ..... 14E7[3]
12E5 ..... 12J5, 14A4[3]
12F5 ..... 12SF5[4], 12Q7[4], 12SQ7[4]
12G7 ..... 12Q7, 12SQ7[4]
12H6 ..... 12Q7[4], 12SQ7[4], 14E6[3]
12J5 ..... 14A4[3], 12E5
12J7 ..... 12SJ7[4], 14C7[3]
12K7 ..... 12SG7[4], 12SK7[4], 14A7/12B7[3]
12K8 ..... 14J7[3]
12Q7 ..... 12SQ7[4], 14B6[3], 12G7
12SA7 ..... 12A8[4], 14Q7[3], 6D8[4-1]—42 ohms
12SC7 ..... 14F7[3], 12SL7[4]
12SF5 ..... 12F5[4], 12SQ7[4], 12SL7[4]
12SG7 ..... 12K7[4], 12SK7[4], 14A7/12B7[3], 14W7[3-6]
12SJ7 ..... 12J7[4], 14C7[3]
12SK7 ..... 12K7[4], 12SG7[4], 14A7/12B7[3]
12SL7GT ..... 14F7[3]
12SN7GT ..... 14AF7[3-2]—84 ohms, 14N7[3-2]—84 ohms
12SQ7 ..... 12Q7[4], 14B6[3], 12G7[4]
12SR7 ..... 14E6[3]
12Z3 ..... 14Z3, 12Z5[3]
12Z5 ..... 6Z5/12Z5[3], 14Y4[3] (except when used as voltage doubler)
14A4 ..... 12E5[3], 12J5[3]
14A5 ..... 12A6[3]
14A7/12B7 ..... 12SG7[3], 14H7, 12SK7[3]
14B6 ..... 12SQ7[3], 12Q7[3]
14B8 ..... 12SA7[3], 12A8[3]
14C5 ..... 14A5
14C7 ..... 12J7[3], 12SJ7[3]
14E6 ..... 12SR7[3]
14E7 ..... 12SC7[3]
14F7 ..... 12SC7[3]
14H7 ..... 14A7/12B7, 12SG7[3]
14J7 ..... 12K8[3]
14N7 ..... 12SN7[3-6], 14AF7
14Q7 ..... 12SA7[3], 12A8[3]
14R7 ..... 14E7, 12C8[3]
14S7 ..... 14J7[4]
14W7 ..... 12SG7[3], 14H7[4]
14Y4 ..... 12Z5[7-3]
14Z3 ..... 12Z3, 12Z5[3]
15 ..... 32[3-6]
17 ..... 6P5[3-1]—27 ohms, 76[1]—27 ohms
18 ..... 12A5[3]
19 ..... 1J6G[3]
20J8GM ..... 21A7[3], 14S7[3-1]—50 ohms
21A7 ..... 20J8[3], 14J7[1]—44 ohms
24A ..... 57[3]
25A6 ..... 25B6, 25C6, 25L6, 43[3]
25A7 ..... 32L7
25B5 ..... 25N6[3]
25B6 ..... 25A6, 25C6, 25L6, 43[3]
25L6 ..... 25A6, 25B6, 25C6, 43[3]
25N6 ..... 25B5[3]
25S ..... See 1B5/25S
25Y4 ..... 25X6[4]
25Y5 ..... 25Z5, 25Z6[3]
25Z3 ..... 25Z4[3], 25Y5[3]
25Z4 ..... 25Z3[3-7], 25Z5[3]
25Z5 ..... 25Z6[3]
25Z6 ..... 25Z5[3]
27 ..... 56, 484, 485
30 ..... 1H4G[3]
31 ..... 49[3] (grid #2 tied to plate)
32 ..... 1B4[3]
32L7 ..... 25A7[1]—25 ohms, 3 watts
34 ..... 1A4
35/51 ..... 58[3]
35A5 ..... 35L6[3]
35L6 ..... 35A5[3], 50L6, 6G6[1]—200 ohms, 5 watts
35Y4 ..... 35Z5[4], 35Z4[4], 35Z3[3]
35Z3 ..... 35Y4[3], 35Z4[3], 35Z5[3]
35Z4 ..... 35Z5[4], 35Z3[3], 35Y4[4]
35Z5 ..... 45Z5, 35Z3[3], 35Z4[4]
35Z6G ..... 25Z6[1]—33 ohms, 5 watts, 25Z5[3-1]—33 ohms, 5 watts
36 ..... 77[3], 6C6[3]
37 76
38 ..... 6K6[3], 89[3-6], 6A4[4]
39/44 ..... 6K7[3], 6SK7[3], 78[3], 6D6[3]
40Z5/45Z5 ..... 35Z5[1]—67 ohms
41 ..... 6K6[3], 42
42 ..... 6K6[3], 41
43 ..... 25A6[3], 25B6[3], 25L6[3]
44 ..... See 39/44
45 ..... 46[3] (grid #2 tied to plate)
46 ..... RK15[3] (if grids 1 & 2 are tied together), 45[3] (if grid #2 is tied to plate)
47 ..... 2A5[3]
50A5 ..... 50C6[3], 50L6[3]
50C6G ..... 50A5[3], 50L6
50L6GT ..... 50C6, 50A5[3]
50Y6GT ..... 50Z7[4-7]
50Z6G ..... 50Y6[7-2]—333 ohms, 10 watts 35Z6[7-1]— 50 ohms, 5 watts
50Z7G ..... 50Y6[4]
51 ..... See 35/51
56 ..... 27, 484, 485
56AS 76
57 ..... 24A[3]
57AS 77
58 ..... 35/51[3]
58AS 78
59 ..... 2A5[3], 47[3], RK16[3] (if grids 2 & 3 tie to plate)
70A7GT ..... 70L7[4]
70L7GT ..... 70A7[4]
71A 182A
75 ..... 6Q7[3], 6SQ7[3]
76 ..... 37, 6P5[3]
77 ..... 6C6, 6J7[3], 6SJ7[3]
78 ..... 6D6, 6K7[3], 6SK7[3]
79 ..... 6Y7[3], 6Z7[3-2]—21 ohms
80 ..... 5Y3[3], 5Y4[3]
83 ..... 5U4[3], 5T4[3], 5V4[3]
84/6Z4 ..... KR98, 6X5[3]
85 ..... 6V7[3], 6R7[3]
85AS ..... 6R7[3], 6SR7[3]
88 ..... 83V, 5V4[3]
89 ..... 7B5[3], 41[3], 38[3]
95 ..... 2A5, 47[3]
KR98 ..... 84/6Z4
117L7/M7 ..... 117N7[4], 117P7[4]
117N7 ..... 117P7, 117L7/M7[4]
117P7 ..... 117N7, 117L7/M7[4]
117Z4GT ..... 117Z6GT[4]
117Z6GT ..... 117Z4GT[4] (if used as half wave rectifier)
182A 71A
182B 483
183 483
213 80
216 81
482A 71A
482B 483
483 ..... 182B, 482B
484 ..... 485, 27, 56
485 ..... 484, 27, 56
585 50
586 50
P861 ..... 84/6Z4
879 ..... 2X2[4]
950 ..... 1F4, 1F5G[3]
951 ..... See 1B4/951
986 83
1223 ..... 6C6[3]
1232 ..... See 7G7/1232
1603 ..... 6C6
1611 ..... 6F6
1620 ..... 6J7
1633 ..... 14N7[3-1]—83 ohms
1634 ..... 12SC7
1851 ..... 6AC7/1852[4]
7000 ..... 6J7
7700 ..... 6C6
AD 1V
AF 82
AG 83
AX 01A
D½ 81
DI 80
DEI 27
E 20
G 40
H 01A
KR98 ..... 84/6Z4
LA ..... See 6A4/LA
PZ 47
PZH 2A5
RK15 ..... 46[3] (grids 1 & 2 tied together)
RK16 ..... 59[3] (grids 2 & 3 tied to plate)
RK17 ..... 2A5[3]
RK42 ..... 1G4G[3]

FOOTNOTES

1. Filament series resistor.
2. Filament shunt resistor (not necessary if filaments are in parallel).
3. Use adaptor or install new socket.
4. Use adaptor or rewire existing socket.
5. Use close fitting shield.
6. Can only be used if filaments are in parallel.
7. Can be used if d.c. load current is less than the maximum allowable for the substitute.

—30—

QTC

(*Continued from page 56*)

age committees, and other units serving the merchant marine.

S. C. PENDERED has taken out a cargo vessel. A. Nilson has been assigned to a tanker for a change. W. B. Davis and K. Alexander shipped out together and R. Holm has been shifted to a new cargo assignment. Joseph Shea Rm 2/c was home on leave during February after two years in the Pacific area. E. Kalman has shipped out as chief on a cargo job. T. J. Fald is also on a cargo assignment.

JOINT Maritime Commission of the International Labor Organization met recently in London . . . the American seamen's delegation had been instructed to vote against "any and all provisions of the proposed seamen's charter that conflicted with the hard-won gains and present status of the American seaman." Minimum rate proposed was expected to be below the American minimum.

THE U. S. Maritime Commission announced that thirty-eight more names, honoring the merchant seamen who have lost their lives, have been assigned to Liberty ships under construction. These, together with those previously announced, make a total of sixty merchant seamen who have lost their lives as a result of enemy action and have been so honored. WSA also announced that the Bethlehem-Fairchild yard at Baltimore had produced its 400th cargo vessel with the recent completion of one of the new "Victory" type ships . . . the yard has been open about 4 years. Four of the 62 shipyards doing construction work for the WSA built 100 or more ships each during 1944, it was also announced.

With this increase during the past year as outlined above, which is a sample of what U. S. shipyards are doing, it is no wonder that there has been a shortage of marine radio operators . . . and most likely will continue to be for some time.....73

—30—

WE'VE GOT THOSE HARD TO GET RADIO PARTS!

SEND FOR OUR LATEST FLYER TODAY!

You'll be surprised at the many hard-to-get parts we've been able to get for you fellows. Mikes, multi-testers, meters and many other items. They're yours as long as they last. Send for latest flyer. It's full of merchandise you've been trying to get! Stocks won't last long, so write today.

QUICK SERVICE!

Our central location in the heart of the nation makes it possible to give you quicker service.

In these days of scarcity we have done everything possible to bring you the best in radio parts and equipment. In spite of existing shortages we have made available thousands of items as shown in our printed circulars.

We are determined to give you the same quick service on "hard-to-get" parts as thousands have enjoyed in the past. Because parts move so rapidly these days we intend to continue our policy of publishing an up-to-date list of merchandise every two or three months.

As additional equipment is released, we will be the first to have it. If you are not on our list to receive our flyers—mail the coupon today.

Sincerely,
Leo I. Meyerson
W9GFQ

OUR LATEST GET-ACQUAINTED OFFERS

TUBE AND CIRCUIT REFERENCE BOOK

Here's a handy reference book that meets the demand for simple, easy to understand data on substitution of radio tubes. Contains valuable technical information on tubes and circuits. It's a guide you'll refer to time and again. Send for your copy today! Only 10c postpaid.

TUBE-BASE CALCULATOR ONLY 25c

Here's just the calculator you've been looking for! Tells you quickly, tube characteristics that enable you to substitute available tubes for those hard to get. Only 25c. We pay shipping expense.

GIANT RADIO REFERENCE MAP—15¢

Time zones, amateur zones, short wave stations. Other valuable information. Printed in colors; size 3½x4½ ft. Send 15c to help with packing and mailing.

WE SPECIALIZE IN HALLICRAFTERS

Service men all over the world are learning that the name "Hallicrafter" stands for quality in radio equipment. For many years we have been one of the country's largest distributors of Hallicrafters—"the radio man's radio." We have Hallicrafters available for immediate delivery on priority. For full particulars, write us today.

Mail Coupon Today

Wholesale Radio Laboratories RN-4
744 West Broadway
Council Bluffs, Iowa

☐ Send your reference book "Tubes and Circuits." Here's my 10c.

☐ You bet I want a Tube-Base calculator. 25c is enclosed.

☐ Ship me your radio map. 15c is enclosed for packing and mailing.

☐ Send your free flyer of hard-to-get radio parts.

Name.....

Address.....

Town.....State.....

WHOLESALE RADIO LABORATORIES

744 WEST BROADWAY
COUNCIL BLUFFS, IA.

Auto Radios

(*Continued from page 49*)

perience of the man repairing the receiver will probably determine how quickly the trouble is found.

For the man who has not had much experience with these receivers, the only method possible is to first localize the source of trouble. Operate the set until the intermittent disturbance appears, and then disconnect the antenna and see if any improvement is noticed. If none, then the fault is within the set itself. In the set, the order of attack would be (1) the power supply, especially the vibrator and buffer condenser; (2) the ground connections or other wires not securely fastened; and (3) condensers and other compents, tapping tubes, etc. With this method, the places more apt to cause trouble are attacked first.

Until now only brief mention has been made of the car's electrical system and its effect on the radio set. Let us now investigate this system with the idea of determining how its operation will affect the receiver and the possible remedies available for counteracting the interference produced.

A simplified circuit arrangement of an auto ignition system is given in Fig. 4. Whenever the breaker points are closed, then current flows in the primary circuit. This flow of current, however, is rapidly interrupted by the action of the rotating cam which is mechanically attached to the engine. As with the vibrator unit, the pulsating primary current through the ignition coil will induce large a.c. voltages across the secondary windings. One end of the secondary coil is attached to the distributor; the other end is grounded through the battery. The condenser across the cam aids in the action of building up a large voltage across the secondary.

Inspection of Fig. 4 will reveal that whenever the distributor arm makes contact with one of the contact points,

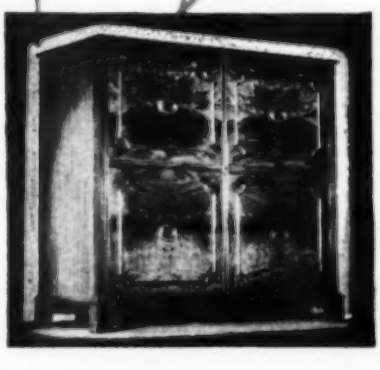
"make it a ..." STROMBERG-CARLSON

for the main radio in your home

Many of our friends in the trade are telling us that our current advertising expresses soundly the basic superiorities of Stromberg-Carlson products. This idea that the *main radio* in a home should be as fine a radio as its purchaser can buy—a *Stromberg-Carlson*—is being carried to the public by over 475,000,000 impressions in thirteen leading national magazines.

Experienced radio merchants feel they can profitably tie their own post-war merchandising plans to this theme. For they rate Stromberg-Carlson as: the *important* radio line; the radio line that will make real *profits;* the radio line with assured and growing *public acceptance.*

You, too, will want to organize your own post-war selling program around this widely accepted Stromberg-Carlson sales theme. You'll find the Stromberg-Carlson *"main radio"* a profit maker—whether in an outstanding table model, console, or radio-phonograph combination. Write for the name and address of your distributor, who will be happy to supply additional information about Stromberg-Carlson.



STROMBERG-CARLSON

ROCHESTER 3, NEW YORK
RADIOS...TELEVISION...
TELEPHONES AND
SOUND EQUIPMENT

ALLIANCE RESUMES PRODUCTION on One Standard Model

● We are now able to return to production of one standard variation of Alliance Model 80 Phono-motor, according to the following definite specifications and on the production plan explained below.

STANDARD SPECIFICATION No. 811—Turntable No. Y-278-S2; 110 Volt, 60 cycle, 9" Model 80

Production must be on the following practical basis under present conditions where there are no large volume priority orders—namely, by accumulating a sufficient quantity of small orders with necessary priority and making periodical single production runs at such time as the quantity of accumulated orders is enough to make this practical. Priority orders (currently only orders of AA-3 or higher, with GOVERNMENT CONTRACT NUMBER and MILITARY END USE, or where certified to be used in Sound Systems, Intercommunications or Paging Systems, as exempted from under M-9-C) must allow delivery time required to obtain a minimum practical production run; to procure material for all orders in hand, and make one production run of the one type standard unit only, for shipment on the various accumulated orders. ● Check the above against your requirements, and if you have proper priority, communicate with us.

REMEMBER ALLIANCE—Your Ally In War as In Peace!

AFTER THE WAR IS WON, WE WILL TELL YOU ABOUT SOME NEW AND STARTLING IDEAS IN PHONO-MOTOR

ALLIANCE MANUFACTURING COMPANY
ALLIANCE, OHIO

HOWARD
CRYSTAL HOLDERS

Built to Your
SPECIFICATIONS

Tested, used, and *proved* by the armed forces of our country, Howard Crystal Holders are ready to serve *you* in peacetime. Dependability, accuracy, and assured performance are the results of precision work by HOWARD'S skilled personnel. Send your specifications to HOWARD.

★ BUY WAR BONDS ★

HOWARD MANUFACTURING CORP.
COUNCIL BLUFFS, IOWA

the large secondary voltage is impressed across one of the spark plugs and a spark jumps across the gap, firing the gasoline vapor (gas mixed with air), and thus causing the attached pistons to move. This is roughly the action of the main electrical system of the car. Its wires, it will be noticed, lead directly to the battery where those from the radio are also attached. This, then, might easily be a path for disturbances to travel on, from the ignition system to the radio.

In addition, there are likewise wires going from the "hot" lead of the storage battery to other electrical devices on a car, such as lights, the horn, generator, cigarette lighter, etc.

With the exception of the generator, we need be little concerned with these other devices for they rarely are the cause of trouble to the radio set. All that is generally required is to see that the leads carrying current to these devices are sufficiently shielded, well grounded, and placed as far away from the radio set wires as possible. The generator, where trouble may arise, will be dealt with in conjunction with the ignition system. The remedies for both are much the same.

Although Fig. 4 illustrates a complete ignition system layout for only several types of automobiles, it can, in general, be used for all types. There are some variations in the construction of the ignition coil and method of connecting the battery in the car, but the general problems of eliminating noises still hold.

This diagram will be used to show how interference generated here may be eliminated. The disturbances can reach the radio either through radiation from the leads carrying these rapidly-changing currents or by conduction along the metallic paths to the receiver. A great deal of the interference picked up by the latter means can be eliminated very effectively if the receiver case is well grounded. This will not, however, eliminate interference brought to the set via battery leads. Incidentally, the reader can judge the importance of good ground connections by the great number of times this latter statement has been made. Nine-tenths of most auto radio trouble would not exist if proper precautions were taken when shielding and grounding the various components.

To prevent interference caused by the ignition system from doing any damage at all, it is necessary to suppress this at its source. Preventive measures consist mainly of employing small by-pass condensers and carbon resistors (generally called suppressors) as shown in Fig. 4. These suppressors are placed at two points: the distributor arm or at the spark plugs. The need for these filters (for that is what they are) arises from the action in each of these circuits. Each will now be considered in turn.

At the ignition coil itself, large alternating currents generated in the secondary may be the source of inter-

NOW AVAILABLE FOR PROMPT DELIVERY ON PRIORITY OF AA-3 OR BETTER!!

The Model PB-200

MULTI-METER

Features:—

- **SPEEDY PUSH BUTTON OPERATION:**
  - A. Press one button to select the service.
  - B. Press another button to select the range.

  (*All* services available with the test leads in same tip jacks. Extra jack used only when switching to 1500 Volt range.)

Sensitivity:—

2000 OHMS PER VOLT
ON BOTH A.C. AND D.C.!!

Measures:—

A.C. VOLTAGES TO —
1500 VOLTS

D.C. VOLTAGES TO —
1500 VOLTS

D.C. CURRENT TO —
1.5 AMPERES

CAPACITY TO —
30 MFD.

DECIBELS TO —
+58 D.B.

RESISTANCE TO —
2 MEGOHMS

- USES NEW 4½" SQUARE 0-200 MICROAMPERE METER.
- DIRECT READING—ALL CALIBRATIONS PRINTED DIRECTLY ON METER SCALE IN LARGE EASY-TO-READ TYPE.
- HOUSED IN RUGGED HEAVY-DUTY OAK CABINET.
- COMPLETELY SELF-CONTAINED—RESISTANCE RANGES OPERATE ON SELF-CONTAINED BATTERY. 110 VOLT 60 CYCLE CURRENT REQUIRED ONLY WHEN MEASURING CAPACITY.

Specifications:—

6 A.C. VOLTAGE RANGES:
0 to 15/75/150/300/750/1500 Volts.

6 D.C. VOLTAGE RANGES:
0 to 15/75/150/300/750/1500 Volts.

6 OUTPUT METER RANGES:
Same as A.C. Voltage Ranges.

4 D.C. CURRENT RANGES:
0 to 15/75/300 Ma. 0 to 1.5 Amp.

2 CAPACITY RANGES:
.001 Mfd. to .3 Mfd.
.1 Mfd. to 30 Mfd.

3 DECIBEL RANGES:
−10 to +18 +10 to +38 +30 to +58.

4 RESISTANCE RANGES:
0 to 2000/20,000/200,000 Ohms 0 to 2 Megohms.

Model PB-200 comes housed in hand-rubbed Oak portable cabinet, complete with cover, self-contained battery, test leads and instruction ..... Net Price **$35.75**

SUPERIOR INSTRUMENTS CO., Dept. RN, 227 Fulton Street, New York 7, N. Y.

6 ways to be your own boss!

NOW, more than ever before, is the **right** time to start a small profitable business of your own ...or train yourself for a practical money-making trade in which you can be **independent.** TODAY take your first step, without cost or obligation. Just mail coupon—and by return mail you will get full information on the courses listed here.

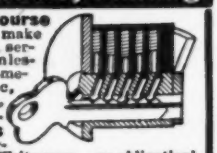
watch and clock repairing

LEARN AT HOME... IN YOUR SPARE TIME. Prepare for a happy future of prosperity, security ... and get a big-pay job now. You can **EARN WHILE YOU LEARN.** Excellent field for part-time work at home. **PRACTICAL COURSE IN HOROLOGY** Thorough self-instruction training in American & Swiss watches, clocks. Special sections on alarm clock repairs. Interesting LEARN-BY-DOING instruction method. Learn **QUICKLY,** easily. No previous experience necessary. WATCHMAKING IS BASIC TRAINING FOR AIRCRAFT INSTRUMENT WORK and other scientific precision jobs.

Amazing Low Price! Money-Back Guarantee! Get into this fast-growing field NOW... big opportunity. Mail coupon below for **FREE** information. No obligation.

locksmithing and key making

Practical Up-To-Date Course How to pick locks, de-code, make master-keys, repair, install, service, etc. New self-instruction lessons for every handy man, homeowner, carpenter, mechanic, service station, fix-it shop, hardware dealer or gunsmith.



35 Easy Illustrated Lessons Low Price! Satisfaction guaranteed or your money back. Write now... no obligation!

practical RADIO servicing

SELF-INSTRUCTION COURSE Teaches you the **practical** side of radio ... repair, adjustment, operation, alteration, trouble-shooting. No previous knowledge is necessary. Large clear illustrations, diagrams, charts, etc. **Interesting STEADY WORK** Set up a radio repair shop of your own—or prepare for booming industrial electronics. This useful, how-to-do-it course brings you all the fundamentals, including mathematics, review questions, problems, answers. Strictly up-to-date. Low price. Send Coupon below for information!

MAIL ORDER BUSINESS

Your Big Opportunity!

24-lesson course on proved, tested, up-to-date **profitable** methods. Amazing treasure-house of the best mail order plans & practices. How to start your mail order business on a small one-man scale... how to keep it growing more and more profitable month after month. Money-making FACTS! Mail coupon below for full details.

Practical REFRIGERATION

BRAND NEW STREAMLINED COURSE for quick training. Authoritative step-by-step instruction on servicing household refrigerators . . . how to install, operate, repair. Easy-to-follow illustrated directions on trouble-shooting, parts replacement, testing. Covers *quick-freeze* units, lockers, water coolers, freon, air-conditioning systems, etc. Unusual low price. Free details—mail coupon.

AUTO mechanics

Let this **practical, low-priced** course get you started in the auto repair trade. Good mechanics make big money NOW... and have a *great future!* Self-training lessons show you exactly what to do and **how to do it.** Teaches servicing on all makes of cars... adjustments, tune-ups, etc. Clearly written and illustrated by expert engineers. Satisfaction or refund. **FREE** details.

Nelson Co. Dept. 8D59, 321 S. Wabash Ave., Chicago 4, Ill.

WRITE FOR COMPLETE DETAILS ON ANY OF THESE COURSES. Just send Coupon for World-Famous Copyrighted Success-Catalog—IT'S FREE! Write today.

FREE details... mail coupon!

Nelson Co. Dept 8D59, 321 S. Wabash Ave., Chicago 4, Ill.

Please send me—FREE and without obligation—illustrated Success-Catalog containing information about the course (or courses) I have checked below. No salesman will call.

☐ Watch and Clock Repairing ☐ Practical Radio Servicing
☐ Locksmithing, Key Making ☐ Mail Order Business.
☐ Practical Refrigeration ☐ Auto Mechanics

NAME.....

ADDRESS.....

CITY..... STATE.....

ference. The end of this winding that connects to the battery can be bypassed with a small ½- or 1-μfd. condenser that can be mounted directly on to the case of the ignition coil. One lead from the condenser connects to the terminal of the coil. This is shown in Fig. 4. The other side of the condenser is grounded through its own case to the body of the car.

The opposite end of the secondary winding goes to the distributor arm. Of late, automobile engineers have made this as short as possible. This has helped considerably, but in any event, it must be thoroughly shielded and grounded.

For most receivers this condenser across the primary will eliminate any of the interference from reaching the battery. In more severe cases, it has been found helpful to place two other condensers along the primary circuit. One is at the ignition switch and the other is at the ammeter. Fig. 4 shows the placement of these condensers and it should be noticed that each one is placed on the side of the device leading to the battery. The condensers used here have the same value as given above and are of the same type. Their construction again allows them to be mounted directly at the meter or switch, most of the time merely by using the same screws holding these parts in place.

The next source of trouble may be found at the distributor. Here, a rapidly rotating arm directs the high a.c. voltage from the ignition coil to the various spark plugs in turn. As contact with each point is made, a small spark is generated between the rotating distributor arm and the contact leading to the spark plugs. At the same time, the spark plug fires. The spark continues for a short period of time and generates a wide band of frequencies causing interference to the receiver by radiation from the leads going either from the ignition coil to the distributor, or the six or eight wires from the distributor to the spark plugs.

The method most commonly employed to suppress any oscillations here is based on the fact that resistance in an oscillatory circuit tends to decrease the amplitude of the oscillations, finally suppressing them entirely if the resistance is large enough. In the present case, the resistance, generally around 10,000 ohms, is placed in the lead going to the distributor rotating arm. Its position is as close to the end of the arm as possible in order to prevent the interference from going any appreciable distance which may enable it to do some radiating.

In cars built before 1937, it was also necessary to place a suppressor resistor in each lead going to the spark plugs. This, in addition to the distributor resistor. For most of the late models, such drastic measures are not necessary, the distributor resistor sufficing. The various types of these resistors that may be bought at any wholesale radio house are shown in Fig. 1, and are very cheaply priced.

The final place where any extensive interference may arise in the car's electrical system is at the generator. The voltage developed at the brushes of this generator is never pure d.c., but rather has a certain amount of ripple in it. Since this represents a.c., and since the generator is directly connected to the battery, it is quite obvious how this may affect the radio. In addition, if the wires carrying this a.c. current are of any appreciable length, then radiation to the antenna of the receiver may likewise become a problem.

Another point in this unit where disturbances may arise is at the brushes where sparking can occur. Sparking is due to a variety of causes and its presence indicates very definitely that the generator is not operating at optimum conditions. The remedies consist of adjusting the brushes so that they fit exactly the contours of the commutator, cleaning and eliminating (by a lathe, if necessary) any grooves that may be found here and by undercutting the mica to some depth below the surface of the commutator. It is not recommended that the radio serviceman correct any of the above faults unless he is experienced at this. The interference caused by sparking is generally of a higher frequency and because of this, is capable of greater persistence before it is eliminated.

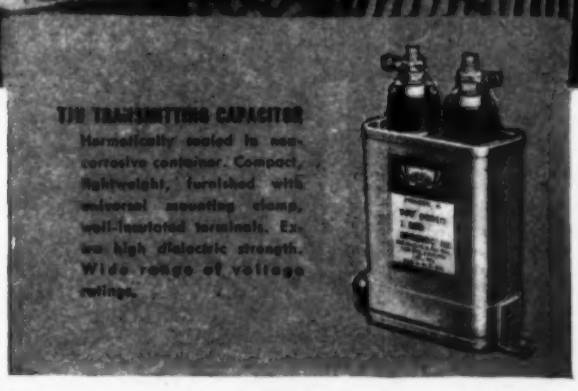
The method most widely used to eliminate this type of interference is to by-pass these disturbances with a small fixed capacitor mounted directly on the generator case and connected to the lead going to the battery. The other end of the condenser is grounded through its case and care should be taken to see that a good ground (again) is obtained. The value of this condenser is ½ μfd. with an operating voltage of 200 volts.

The Antenna

The antenna of an auto radio is the only connection between the shielded receiver and the radio electromagnetic waves. Unlike home sets, the antenna is definitely necessary for any reception to take place. Hence, here, more consideration must be given to its placement since a poor location on the automobile can easily result in noisy and unsatisfactory operation.

The first models placed the antenna in the roof, this being as far from the motor and other high tension wires as possible. Today the greater majority of cars use the so-called "fish-pole" antennas mounted directly on the outside of the car. A small number still use an antenna placed beneath the running board. This type, however, is rapidly disappearing because it is more difficult to install, more easily damaged and not as capable of receiving signals as the above antenna. The latter arises from the well-known fact that the received signal strength increases with the height of the antenna above the ground.

The "fish-pole" antennas may be mounted in a variety of places on the


TIR TRANSMITTING CAPACITOR
Hermetically sealed in non-corrosive container. Compact, lightweight, furnished with universal mounting clamp, well-insulated terminals. Extra high dielectric strength. Wide range of voltage ratings.

Vigilance in little details is second-nature to C-D craftsmen.

Accuracy is their creed.

With such watchful care, capacitor-building becomes a precise science . . . a science that has earned for Cornell-Dubilier capacitors a world-wide reputation for quality and dependability.

If you have a capacitor problem, you may find the answer in one of our basic innovations in design, engineering or manufacture. Cornell-Dubilier Electric Corporation, So. Plainfield, N. J. Other plants: New Bedford, Brookline, Worcester, Mass., Providence, R. I.

CORNELL - DUBILIER CAPACITORS 1910 1945

WET AND DRY ELECTROLYTICS · MICA · DYKANOL · PAPER

WAR-TESTED

During the critical stress of battle, men and equipment prove themselves. Materiel that has performed dependably under the highly abnormal War conditions has stamina to spare in normal peacetime operation. Atlas Sound Loud Speakers have come through their War tests with flying colors. War-tested Atlas Sound Speaker manufacturing facilities and personnel will soon be ready to go to work for you again on new designs or minor conversions. Contact them for details.

COMPLETE CATALOG ON REQUEST

ATLAS SOUND

CORPORATION

1447 39th Street • Brooklyn, N. Y.

If you want

- CRYSTALS
- CABLES
- HARNESSES
- ELECTRONIC ASSEMBLIES
- CABINETS

Telephone Peru, Indiana

151

Serving the Radio and Electronic Industries with precision engineered products.

Wm. T. WALLACE MFG. CO.

General Offices: PERU, INDIANA

Cable Assembly Division: ROCHESTER, INDIANA

body of the car itself. A few of the more usual positions are listed below.

1. On the fender.
2. On the side cowl of the car.
3. Just above the windshield, midway from either side of the car.
4. At the rear of the car, mechanically attached to one end of the back bumper.
5. On the hinge pin of a car door.

Many of these antennas are of the telescopic type and hence it is possible to adjust their length. Average lengths available at any wholesale radio house vary from 25" to 96", the latter generally in three sections. For longest use they should be frequently coated with a thin layer of light oil.

The lead-in wire from the antenna to the receiver must be weatherproofed in addition to the usual shielding. Grounding of the shield should be done, at least, at two places: once where the cable leaves the antenna proper, and once where it enters the receiver. One annoying source of trouble occurs when the lead-in wire manages to scrape up against its grounded shield. Corrosion and continual vibration are generally the cause for this.

The serviceman is greatly profited by experience when auto radios are brought in for repairs. However, the above discussion of the points of probable failure should prove helpful even when he has no previous background to fall back on. Radio servicing is a science, whether the job is on an auto set or a home receiver. If the principles are correctly applied, with thought, the results must always lead to a proper solution of the problem.

-30-

MORE VOLUME FROM A CODE BUZZER

By C. A. Adams

FOR practicing radiotelegraph code, a high-frequency buzzer has a sometimes serious drawback: limited volume.

Its dits and das are loud enough for a single would-be "ham". But if a group is studying code or there is much house QRM, the peep of a buzzer is too feeble to be read comfortably.

A simple and effective way of adding more sock is to use the buzzer with a phonograph. Remove the buzzer from the wood base of the practice set. Connect long flexible leads. Place the buzzer on the stationary turntable of the phonograph. Let the needle rest on the buzzer case; and prepare to be surprised when you start keying.

This setup makes the phonograph an audio amplifier for the buzzer. It will deliver all the volume a code class would need, even under noisy conditions. Also, the quality of the note can be changed by adjusting the tone control.

In addition to having an R9 signal, the student can become accustomed to reading code over a loudspeaker. This is important because a speaker is used in the code test for a "ham" license.

If a so-called wireless record player is used, the code can be picked up on two or more receivers, located in different rooms. In this way one veteran op can teach a large class of students.

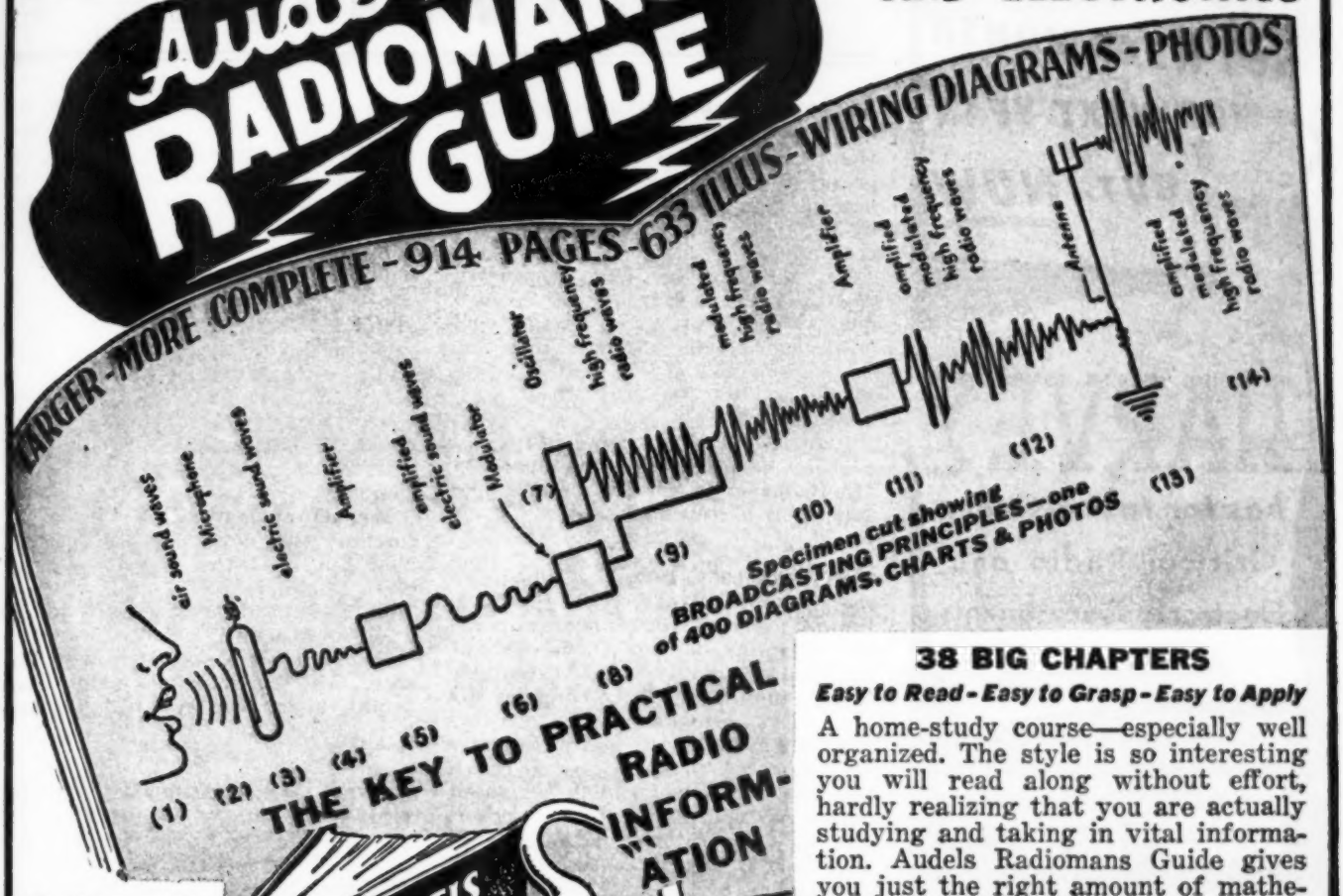
-30-

NEW EDITION NOW READY

Audels RADIOMANS GUIDE

Includes TELEVISION AND ELECTRONICS

LARGER - MORE COMPLETE - 914 PAGES - 633 ILLUS - WIRING DIAGRAMS - PHOTOS



Specimen cut showing BROADCASTING PRINCIPLES—one of 400 DIAGRAMS, CHARTS & PHOTOS

THE KEY TO PRACTICAL RADIO INFORMATION

It gives you in usable form pointers on radio, including frequency modulation, television, etc. Also valuable inside information for Aviators, Marines, Commercial Operators and Technicians, Servicemen and Students.

Q AND A UNIQUE QUESTION and ANSWER METHOD

Highly Endorsed

38 BIG CHAPTERS

Easy to Read - Easy to Grasp - Easy to Apply

A home-study course—especially well organized. The style is so interesting you will read along without effort, hardly realizing that you are actually studying and taking in vital information. Audels Radiomans Guide gives you just the right amount of mathematics required to cope with radio problems successfully. You can solve, with the aid of this extraordinary book, practically every radio problem that comes up. At your finger tips is a complete index for instant use.

1001 RADIO FACTS AND FIGURES

A Complete Library In One Book

AUDELS RADIOMANS GUIDE gives authentic Principles and Practices in Construction, Operation, Service and Repairs. Covers clearly and concisely radio fundamentals—Ohm's Law—Physics of sound as related to radio science—Measuring instruments—Power supply—Resistors — Inductors — Condensers — Transformers and examples—Broadcasting stations—Radio Telephony—Receivers — Diagrams — Construction — Control Systems — Loudspeakers — Antennas — AutoRadio — Phonograph Pick-ups—Public Address Systems—Aircraft and Marine Radio — Radio Compass — Beacons — Automatic Radio Alarms—Short Wave—Coil Calculations—Testing—Cathode Ray Oscillographs — Static Eliminations — Troubleo Pointers — Underwriter's standards — Units and tables. REVIEW QUESTIONS—READY Reference Index.

7 DAYS' FREE TRIAL

THEO. AUDEL & CO., Publishers
49 West 23rd Street, New York 10, N. Y.

Mail AUDELS NEW RADIOMANS GUIDE for free examination. If O. K. I will send you $1 in 7 days; then remit $1 monthly until $4 is paid. Otherwise I will return it.

Name .....

Address .....

Occupation .....

Reference .....

$4 COMPLETE

PAY ONLY $1 A MO.

MAIL THIS COUPON TODAY

HARVEY

has for fast delivery

Critical Radio and Electronic Components and Equipment

TUBES	METERS
RELAYS	TEST EQUIPMENT
CAPACITORS	TRANSFORMERS
RESISTORS	ETC., ETC.

After 18 years in the radio and electronic field, HARVEY is adept at supplying you with equipment you need—not next week, not next month, not next year—but now, just when you need it. *That's the service for which we are famous.* Critical items, if not on our shelves, will be traced for you, or we may be able to suggest effective substitutes. And HARVEY can help solve your priority problems, lend a hand with technical advice. Save time, save money . . . see HARVEY—first, last, always!

Telephone Orders to LOngacre 3-1800

hrc

HARVEY RADIO COMPANY

103 WEST 43rd ST., NEW YORK 18, N. Y.

Within the INDUSTRY

AMERICAN RADIO HARDWARE COMPANY, INC., has recently appointed J. Homer Robinson to the post of vice-president and general sales manager, according to the announcement made by Mr. D. T. Mitchell, president of the company.

Mr. Robinson has been associated with the radio industry for over a quarter of a century, serving in various capacities at National Union Radio Corporation, Freed Radio Corporation and the DeForest Radio Corporation.

Plans for the postwar activities of ARHCO have not been announced by Mr. Robinson as yet, but the new program will be revealed shortly.

* * *

PRESS WIRELESS, INC. has announced the appointment of Joseph W. Chaplin as Director of Communications. Mr. Chaplin succeeds D. K. deNeuf who recently resigned.

Mr. Chaplin joined the company fifteen years ago when the eastern terminal on Long Island was in its early stages of development, as a radiotelegrapher. He was rapidly advanced to the position of general supervisor, director of operations and managerial assistant.

* * *

HORACE H. SILLIMAN, former sales executive for several radio companies, has accepted the post of district manager for the New England and New York State territory of the Bendix Radio Division. He will supervise the new line of Bendix radios and radio-phonograph combinations.

Mr. Silliman has been associated with the radio industry for the past 20 years in executive capacities with the A. C. Gilbert Company, Splitdorf Electrical Company, Thomas A. Edison, Inc., United American Bosch Corporation, and Detrola Corporation.

* * *

UNIVERSAL MICROPHONE COMPANY has enlarged its service department to facilitate the handling of repairs of microphones, stands and accessories. This department was formerly part of the commercial division.

The new department is in charge of Robert Ramsey, who joined the company a year ago upon his discharge from the Army. The entire Universal engineering staff will be available for consultation on service problems.

The company also announced the appointment of Dunford Kelley, recently a staff engineer with Littelfuse, Inc. to the staff of the company as electromechanical engineer. He has been assigned to duties in conjunction with Army and Navy contracts and the postwar production of microphones.

* * *

LEWIS E. DORFMAN has been appointed sales representative for the Belmont Radio Corporation, according to the announcement made by P. S. Billings, president of the company.

Mr. Dorfman's territory will cover New York City, New England, and New Jersey. His offices are located at 1780 Broadway, New York.

Prior to his association with Belmont, Mr. Dorfman was sales representative for the Admiral Corporation in the same territory.

* * *

GALVIN MANUFACTURING CORPORATION has promoted two of its veteran engineers in the home radio division of the company.

William E. Cairnes will become chief engineer of the home radio division while Gus Wallin will act as assistant in the same division.

Mr. Cairnes has been employed by the company for eight years, while Mr. Wallin has been associated with the organization for five years.

They will be in charge of the design and production of the peacetime Motorola radios for the home.

* * *

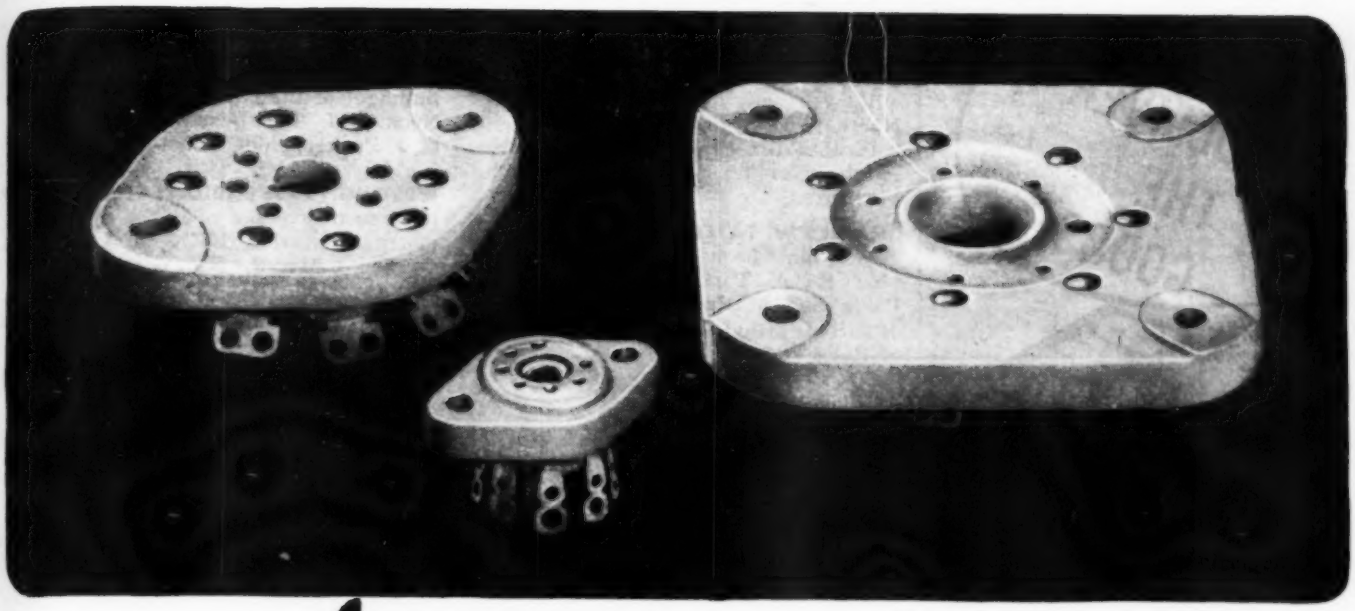
MANUEL ORTIZ, JR., manager of the foreign division of the Hallicrafters Company of Chicago has announced the removal of the foreign division to larger quarters at 1791 Howard Street, Chicago.

This move is in line with the company's announced policy of enlarging its export facilities after the war. The company manufacturers high-frequency radio equipment.

* * *

ANSLEY RADIO CORPORATION has appointed three new representatives to handle its line of Dynaphone radio-phonograph combinations.

Fred A. Wibe of St. Louis, Missouri will cover the Eastern Missouri, Southern Illinois, Southern Indiana,



WHO *first* MADE IT?

Pardon us, if we presume to insert the "first," but in casting about for suppliers you've asked that question, perhaps hundreds of times.

Users of ceramic sockets will recognize the types illustrated. The No. 267 was the first ceramic miniature socket — still widely used, and formed the basic design for the later types with cylindrical metal shield base. (Yes, Johnson makes them too, our No. 277B.)

The No. 228 octal is one of a series of oval ceramic wafer sockets originated 7 years ago. Engineering improvements then made over existing types (such as mounting bosses, countersunk rivet heads, "non-turning" contacts, etc.) established it a favorite for Signal Corps and Navy equipment.

Almost equally familiar is the basic square design of the No. 247, a series started 6 years ago, embodying essential features of the smaller Johnson sockets.

But to get back to the first question, "Who (first) made it?" when you're looking for original parts, tube sockets, or other components why not avail yourself of our kind of engineering and production experience?

Ask for catalog 968(Z)

Specialists in

- CONDENSERS
- INSULATORS
- SOCKETS
- PLUGS
- INDUCTORS
- CHOKES
- COUPLINGS
- ANTENNA PHASING UNITS

ARMY E NAVY

JOHNSON

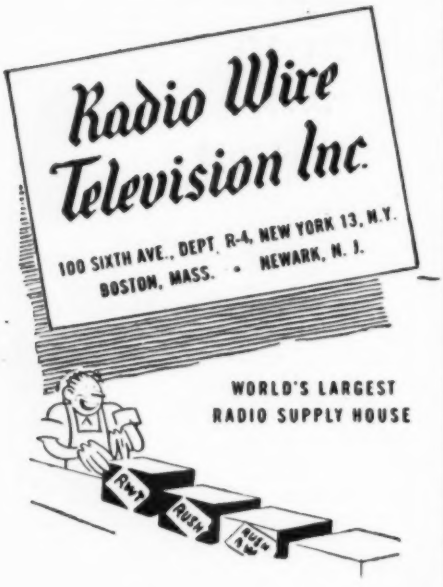
a famous name in Radio

E. F. JOHNSON COMPANY • WASECA • MINNESOTA

10,000 PARTS *immediately available on priorities.*

SAME-DAY SERVICE
Trained expeditors fill your order the day we receive it.

SINCE 1922 *we have been known as reliable and responsible jobbers, wholesalers and manufacturers, of radio and electronic equipment.*


Radio Wire Television Inc.
100 SIXTH AVE., DEPT. R-4, NEW YORK 13, N.Y.
BOSTON, MASS. • NEWARK, N. J.
WORLD'S LARGEST RADIO SUPPLY HOUSE
BWT
RUSH

Originators and
Peacetime Marketers
of the celebrated

Lafayette Radio

Write today for our bargain flyers and special bulletins.

Southern Ohio, Southeastern Iowa and Western Kentucky.

E. P. McMorrow of Cleveland, Ohio will represent the company in the Northern Ohio area.

H. P. Fillmore, of Buffalo will cover the Northern and Western New York area.

* * *

CHARLES W. TAYLOR, development engineer, has been named manager of the RCA Tube Parts and Machinery Sales division of RCA Victor.

Mr. Taylor will be located at the company's Harrison, New Jersey plant where he will work under the direction of L. S. Thees, manager of RCA's equipment tube section.

Mr. Taylor has been associated with RCA and its predecessor company since 1929, and he has a wide background of development and manufacturing experience. For three years he directed RCA's development and manufacture of cathode-ray tubes and has been associated with the transmitting tube laboratory and receiving tube production.

* * *

GENERAL ELECTRIC COMPANY has appointed two new sales managers in the Tube Division of the company.

L. R. O'Brien and R. W. Metzner, both formerly executives of the Ken-Rad Tube and Lamp Corporation, will be responsible for the sales of both Ken-Rad and G.E. brand tubes.

Mr. O'Brien will be in charge of the sale of Equipment Tubes, while Mr. Metzner is in charge of Replacement Receiver Tubes.

Mr. O'Brien's headquarters will be in Chicago, and Mr. Metzner will work out of the Schenectady office of the company.

* * *

TEMPLETONE RADIO MANUFACTURING CORPORATION, producers of Temple Radios, has opened a new plant at New London, Conn.

With this move Templetone concentrates its entire radio and electronic production in the new plant, which has an area of over 100,000 square feet.

The Templetone plant at Mystic will be devoted exclusively to the production of furniture, providing almost unlimited facilities for postwar manufacture of radio cabinets.

* * *

THE MAGNAVOX COMPANY, through its national sales manager, G. H. Smith, has announced the appointment of V. J. Sanborn as the Cleveland District Sales Manager of the radio-phonograph division.

Mr. Sanborn, who has established his headquarters in Cleveland, will supervise all sales in the Ohio and Kentucky areas.

* * *

SPERRY GYROSCOPE COMPANY has announced the appointment of L. V. Bedell to the post of manager of the company's electronics plant at Garden City, L. I.

Mr. Bedell was formerly assistant manager of the Nassau plant at Great Neck, L. I. This post will be filled by G. J. Parker, chief industrial engineer.

* * *

WESTINGHOUSE RADIO STATIONS, INC. has recently taken over the operation of radio station KEX in Portland, Oregon. Mr. J. B. Conley, former manager of the company stations, WOWO and WGL at Fort Wayne, has been appointed general manager of KEX.

The purchase price was $400,000; in addition the company spent $100,000 for new quarters and facilities. The station will retain its Blue Network affiliation and continue to transmit on a frequency of 1190 kilocycles at 5000 watts power.

* * *

STEWART-WARNER CORPORATION has promoted three men "from the ranks" to fill important new positions with the company.

Mr. Arden LeFevre has been appointed vice-president and director of engineering for Division One, the alemite, instruments and radio division. He succeeds the late Fred Johnson, director of engineering.

Mr. Fred R. Cross formerly with the advertising department of the company has been promoted to the post of advertising manager, while Mr. George W. Oehlsen, Jr. becomes assistant director of engineering of Division One, assisting Mr. LeFevre.

* * *

ASSOCIATED ELECTRONICS CORPORATION has announced its removal to a new location at 132 Nassau Street, New York 7, New York. The new telephone number is BE 3-3912. The company is a consulting engineering firm.

* * *

THOMAS A. WHITE who has been associated with Jensen Radio Manufacturing Company for the past 17 years was recently elected to the position of president and general manager of the company.

Mr. White joined the Jensen organization in 1928 in the capacity of sales manager. He was made vice-president in charge of sales and advertising in 1940.

Mr. White succeeds W. E. Maxon who retired at his own request.

The new president of Jensen is a well-known figure in the radio industry. He is a graduate of the University of Minnesota College of Electrical Engineering. At the present time, he is a vice-president of the RMA and chairman of the amplifier and sound equipment division.

* * *

BARTH-FEINBERG, INC. has announced the addition of the Sonora line of records, radios, phonographs, combinations, FM and television receivers for the New York area. They have been

KAAR 50 and 100 WATT INSTANT HEATING MOBILE OR FIXED RADIOTELEPHONES

A new series of KAAR radiotelephones, offering improved performance and greater convenience, is now available to police and fire departments, public utilities, sheriffs' offices, railroads, the forestry service, and similar users of radiotelephone communication. Designed with the needs of these services in mind, this series provides instant heating tubes, single channel or five channel operation, and crystal controlled or tunable receivers. Notice how compact this equipment is, and how it is immediately accessible for tuning or servicing, although the cabinet itself may be permanently secured to a shelf, wall, vehicle, or vessel.

SERIES 46 • 50 WATT KAAR RADIOTELEPHONE

A five channel transmitter with power output of 50 watts. All five channels are independently tuned, and any one may be instantly selected by turning a knob on the front panel. Standard frequency range is from 1600 to 6000 Kc. Furnished with companion tunable or fixed tuned crystal-controlled receiver as desired. Power supply (8"x8"x17") is a separate unit, interconnected by a 12-foot cable. Available for operation on 117 volts 60 cycle A. C., 12, 32 and 110 volts D. C.

SERIES 96 • 100 WATT KAAR RADIOTELEPHONE

(NOT ILLUSTRATED)

Five channel instant-heating transmitter, with an output of 100 watts and having a standard frequency range from 1600 to 6000 Kc. The companion receiver may be of the tunable or fixed tuned crystal-controlled type as desired. R. F. ammeter and plate milliammeter are mounted on front panel. This 100 watt radiotelephone, including transmitter and receiver, is only 19½" high, 22" wide, 14¾" deep. Furnished with separate power supply (8" high, 16" wide, and 17" deep). Available for operation on 117 volt 60 cycle A.C., 32 or 110 volt D.C. circuits.

KAAR ENGINEERING CO.

KAAR ENGINEERING CO.

PALO ALTO • CALIFORNIA

Export Agents: FRAZAR & HANSEN, San Francisco

COMPARE THE ADVANTAGES

. . . and you will get a **KAAR 46!**

★ **INSTANT HEATING TUBES...** Stand-by current is zero—yet there is no waiting for tubes to warm up before sending a message! Reduces drain on batteries . . . extremely important in mobile or marine operation.

★ **FIVE CHANNEL TRANSMISSION...** Any one of five channels from 1600 to 6000 Kc can be instantly selected by turning the large knob on the panel.

★ **CARRY ONLY 1 SPARE TUBE...** For simplicity of replacement there is only one type of tube used in these Kaar transmitters. (For 117 volt AC operation, 5R4GY rectifier tubes are also employed.)

★ **REMOVABLE PANEL...** By removing six finger-tight lugs, the front panel of the transmitter may be lifted away, exposing all tuning controls. This allows complete tune-up to be made in a short time without moving the set.

★ **SIMPLE TO SERVICE...** When four screws are released, transmitter slides out like a letter file to simplify tube replacement.

★ **FITS MOST ANYWHERE...** Transmitter may be placed above or below the receiver, or on either side of it. Transmitter and receiver units are each 10" high, 13" wide, 13" deep. This equipment is easy to install.

★ **REASONABLY PRICED...** Although Kaar instant-heating radiotelephones offer all these features for convenience and simplicity, they are competitively priced. Your inquiries are cordially invited.

Enrich the Beauty

of your Mandolins, Spanish or Hawaiian Guitars, and similar string instruments with an easy-to-attach UNIVERSAL MAGNETIC PICKUP. Can be adjusted to any string height.

We also manufacture all types of coils. Just send us your specifications, and we will be pleased to quote prices.

LECTROLAB PRODUCTS

Manufacturers and Designers of Electronic Devices

2806-10 W. HARRISON STREET • CHICAGO 12, ILLINOIS

TOUGH!

Cinaudagraph Speakers are made to take the tough raps. This is the built-in result of better manufacturing experience. Look at the record of achievement and you'll put Cinaudagraph Speakers at the top of your list.

Watch Cinaudagraph Speakers After Victory!

Cinaudagraph Speakers, Inc.

3911 S. Michigan Ave., Chicago

Export Div., 13 E. 40th St., New York 16, N. Y.

"No Finer Speaker in all the World"

appointed exclusive distributor of this line for Greater New York, Suffolk, Nassau and Westchester counties.

The company handles wholesale distribution of musical merchandise and novelties.

* * *

RADIO MANUFACTURERS' ASSOCIATION has released several important items regarding the manpower situation in the industry.

Of the 86,173 persons employed in radio manufacturing for the year 1940, 36,374 or more than one third of that number are now in the Armed Forces. Of this number, 34,446 are men and 1,928 are women.

Jobs for all of the 36,374 veterans who want them will be less than a fourth of the 145,266 positions which the survey estimated would be available in the first full year of peacetime radio production.

Despite the inroads on its skilled workers, the radio industry has increased its production 1300 percent since 1940.

In the second of its statements, the RMA reports that in 1940, 51.9 percent of the employees were women and that women will represent 59.1 percent of the estimated 145,266 workers that will be needed for the postwar operation. This represents an increase in the employment of women of 248.8 percent over 1940.

The third statement was made by R. C. Cosgrove president of the RMA in a recent radio address. He revealed that the radio industry has produced more than four billion dollars' worth of equipment during 1944 alone. This is in contrast to the peacetime volume of radio products amounting to 325,000,000 annually.

* * *

CROWE NAME PLATE AND MANUFACTURING COMPANY of Chicago has announced a change in name through its president, E. C. Coolidge. Henceforth the company will be known as Crowname, Inc.

The company now has three plants devoted to the production of wartime precision components and accessories for electronic equipment, as well as aircraft motor parts and nameplates.

* * *

EMERSON RADIO AND PHONOGRAPH CORPORATION'S Board of Directors has announced the election of Morton E. Ornitz to the post of vice-president of the company.

Mr. Ornitz is a graduate of Syracuse University. He joined the Emerson Radio organization in 1943 as Controller.

* * *

WINCHARGER CORPORATION of Sioux City, Iowa has announced the purchase of the Benjamin Patent (1,841,593) for automatic phonograph record changers.

The patent basically covers drop-type intermixing record changers. The advantage of this changer is that it will handle either 10" or 12" records without requiring any adjustment.

—30—

Keep Your Eyes On Belmont

American progress has been built on a spirit of business competition. And this spirit did not die with the war. Today, it inspires American manufacturers to the greatest efforts in history . . . a determination to out-invent and out-produce the enemy all over the world.

When the nation's inventive and manufacturing genius again can be devoted to the ways of peace, great gains will have been made in America's industrial knowledge and production facilities. And nowhere will these gains be greater than in the field of electronics.

Here at Belmont, we now can say without hesitation that Belmont's post-war television receiving sets will be far superior to anything visualized before the war. Nor do we hesitate to say that Belmont FM Radio receiving sets virtually will eliminate interference and static. And of course, there will be Belmont Radio and Phonograph Combinations which will represent a remarkable advance in performance and value. Keep your eyes on Belmont. Belmont Radio Corporation, 5929 W. Dickens Avenue, Chicago 39, Illinois.

Belmont Radio

RADAR ★ TELEVISION ★ FM ★ ELECTRONICS

Practical Radio Course
(*Continued from page* 50)

tive. It carries the tank capacitor past the discharged condition and begins to charge it in the opposite direction.

(6) The tank capacitor continues to charge (assisted by energy now supplied inductively by L_t from the increasing plate current), and the plate current continues to increase while the grid goes more and more positive. Finally, plate saturation current again is reached.

This series of actions repeats itself over and over continuously. The plate-current fluctuations are illustrated at the right of Fig. 2. A considerable current circulates back and forth round the tuned tank circuit like the to-and-fro movement of the balance wheel of a watch. Meanwhile, the voltage across this tuned circuit rises and falls and reverses regularly, being greatest each time the current is about to reverse.

Summary of the V.T. Oscillator Action

It is evident that this type of vacuum-tube oscillator comprises an energy-storage, oscillation-producing, oscillation - f r e q u e n c y - determining "tank" circuit that is being periodically energized by the action of the plate circuit, which is, in turn, actuated by grid potential derived from that storage circuit. The main function of the vacuum tube is to act as a sort of "trigger" to control the process of drawing energy from the power supply and periodically feeding it to the tank circuit indirectly in correctly *timed* and *phased* impulses so that it will reinforce the energy in the tank circuit, thereby making the entire circuit self sustaining. The vacuum tube is used for this purpose because of its amplifying properties, i.e., less energy is required to operate its grid (trigger control) than is being controlled thereby in its plate circuit.

All oscillators employing vacuum tubes utilize the principle of feeding back a portion of their plate circuit energy to the input or grid circuit. It is apparent that the energy returned to the grid circuit must always act so as to *increase* the output rather than to oppose the action of the circuit, i.e., a voltage from the plate circuit must always be fed back so that with an increasing plate current, this voltage tends to make the grid more *positive*.

The plate and grid-circuit currents in an oscillator tube flow in the form of pulses (see Fig. 1). Although the plate current pulse i_p may have a comparatively small value, the *circulating* current set up in the tank circuit may be of the order of 20 to 50 times as great, depending upon the Q of the tank circuit. High tank-circuit efficiency with high effective Q requires a low-loss (high Q) resonant circuit.

Extracting Useful Power from the Oscillator

A power-consuming load may be capacitively-coupled, or inductively coupled (as by coil L_m in Fig. 1), to the tank circuit in order to absorb oscillating energy from it for external use, and if it is not greater than the capacity of the oscillator to furnish it, it will be supplied. The power losses in the tank circuit and tube, plus the useful power extracted from the oscillator are all furnished by the plate-circuit power supply.

Class C Power Oscillators

In power oscillators, the tube is usually operated under conditions of grid bias, exciting voltage, etc., corresponding to Class C amplifier conditions in order to give a large output with relatively high plate circuit efficiency. The negative grid bias is made more than sufficient to reduce the plate current to zero when no exciting grid voltage is present. Consequently, no plate current flows during more than half of each cycle; plate current pulses of large amplitude flow during only a portion of each "positive" half cycle of the grid excitation. Under these conditions, energy is supplied to the tank circuit in the form of pulses lasting for *less than one-half* of each cycle. By designing the tank circuit so it has low-resistance, and taking advantage of the "flywheel" action of the tank inductor, the tank circuit oscillations are maintained during the full oscillation cycle even though it is receiving energy from the plate circuit during only a part of each alternate half cycle!

The output of a power oscillator contains harmonics as a result of the fact that the plate and grid currents of the tube flow in the form of pulses. The harmonics will be reduced if the effective Q of the tank circuit is made large. A high effective Q of the tank circuit corresponds to a load not too closely coupled, and either to a low L/C ratio in the tank circuit, or an arrangement in which the plate is coupled to only a small part of the tank circuit so that the voltage across the circuit is much greater than the plate-cathode voltage.

High tank-circuit efficiency, on the other hand, requires a high effective Q with a low-loss (high Q) resonant circuit. Consequently the conditions for high tank-circuit efficiency and for low harmonics are conflicting.

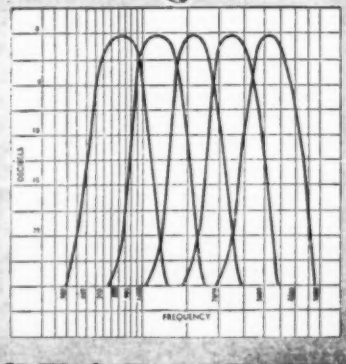
The Grid Leak and Capacitor

Bias in power oscillators is practically always obtained by means of a grid leak and capacitor arrangement, since this makes the oscillator self-starting and tends to make the oscillator self-adjusting at conditions corresponding to good efficiency and good frequency stability.

We have seen that the grid-leak re-

FREED MULTI-CHANNEL FILTER

for frequency selection in remote control systems



Here is a great forward step in filters for frequency selective remote control systems. Consisting of five band pass filters having their inputs in parallel and five separate outputs, it features unusually broad pass band and high attenuation at the adjacent channels, constant electrical stability and power handling capability which makes possible the use of a rectifier and relay directly in the output of the filter. Hermetically sealed and ruggedly constructed for long life and durability.

While no transformers are being made for civilian use, we will reserve a copy of the Freed Post-War Catalogue for you. Send in your name today.

FREED TRANSFORMERS

74 SPRING STREET, NEW YORK CITY

The Greeks gave us a word for it... now we give it to *you*

WHEN Sperry first developed its velocity-modulated, ultra-high-frequency tube, the word "KLYSTRON" was registered as the name of the new device.

This name — from the Greek, as coined by scientists of Stanford University — is an apt description of the bunching of electrons between spaced grids within the tube.

"Klystron" is a good name. So good, that it has come into widespread use as the handy way to designate *any* tube of its general type, whether a Sperry product or not.

This is perfectly understandable. For the technical description of a Klystron-type tube is unwieldy, whether in written specifications, in conversation, or in instructing members of the Armed Forces in the operation of devices employing such tubes.

These conditions have prompted many requests from standardization agencies—including those of the Army and Navy—for unrestricted use of the name Klystron. In the public interest, Sperry has been glad to comply with these requests...

From now on, the name KLYSTRON belongs to the public, and may be used by anyone as the designation for velocity-modulated tubes of any manufacture.

Sperry will, of course, continue to make the many types of Klystrons it now produces, and to develop new ones.

On request, information about Klystrons will be sent, subject to military restrictions.

SPERRY GYROSCOPE COMPANY, INC. GREAT NECK, N. Y.

Division of the Sperry Corporation

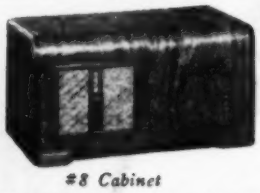
★

LOS ANGELES • SAN FRANCISCO • NEW ORLEANS
HONOLULU • CLEVELAND • SEATTLE

GYROSCOPICS • ELECTRONICS • RADAR • AUTOMATIC COMPUTATION • SERVO-MECHANISMS

LAKE
Radio Cabinets and Parts

Portable Phonograph case, of sturdy durable plywood, in handsome brown leatherette finish. Inside dimensions 16½" long, 14" wide, 9½" high. Has blank meter board. As illustrated above, specially priced at.... $6.95



#8 Cabinet

Also blank table cabinets of walnut veneer in the following sizes, with speaker opening on left front side: (Note: *7 has center speaker grill.)

#1 — 8¼"	L x 5½"	H x 4"	D...	$1.95
#2 —10¼"	L x 6⅜"	H x 5"	D...	$2.75
#3 —13½"	L x 7⅝"	H x 6¼"	D...	$3.25
*#7 —10¾"	L x 7"	H x 5½"	D...	$2.50
#8 —17"	L x 9"	H x 9¾"	D...	$4.50
#9 —21"	L x 9¼"	H x 10½"	D...	$5.50

* Speaker Opening in center of front side. Cabinets available in ivory color and Swedish Modern. Write for prices.

POWER TRANSFORMERS

4, 5, or 6 Tube—6.3V at 2 amp. 50 Mill Power Transformer..... $2.45

7, 8, or 9 Tube—6.3V at 3 amp. 70 Mill Power Transformer..... $2.65

All types of radio parts available in today's market can be obtained at Lake's money-saving prices. Large stock listed in our catalog.

Write for Our Free, New Illustrated Catalog!

LAKE RADIO SALES CO.

615 W. Randolph Street Chicago 6, Ill.

RADIO TUBES FOR SALE
IN5

1L4 with adapter to replace 1N5, complete unit @ $1.25 ea.

(Sold on a money-back guarantee)

6B4	@	$.59 ea.
6SH7	@	.59 ea.
6SN7	@	.59 ea.
7H7	@	.50 ea.

ALL TUBES IN FACTORY SEALED CARTONS, NATIONALLY KNOWN BRANDS

7H7 is directly interchangeable for 7G7 (1232), 7L7, 7V7 and 7A7. 7H7 can be used for 6A7, 6A8 and 6K7 with an adapter. The adapters are available at 50c each. Do not send money in advance; will ship C.O.D. All offers are subject to prior sale. Please send L-265 with order.

PAUL'S RADIO ACCESSORIES

4425 DREXEL BLVD., CHICAGO 15, ILL.

sistor R_g allows the electrons collected by the grid to leak off to the cathode at a comparatively slow rate, to prevent blocking of the grid and also to provide grid bias for the tube during a portion of each oscillation cycle.

Now, the grid leak may be connected in either one of two ways, either as already shown in Fig. 1 and again at (A) of Fig. 3 for convenience, or as shown at (B) of Fig. 3. In the first mode of connection, the grid electrons flow through the grid leak directly to the cathode. In (*B*) they must flow through the tuning coil as well in order to reach the cathode. The action of the grid leak is the same in either case.

The capacitance of the grid-blocking capacitor, C_g, should be large enough so that its reactance over the range of oscillator frequency desired will be low enough to keep the alternating voltage drop across it small—since such voltage drop opposes the grid excitation voltage. The capacitor should not be too large, however, since then the oscillations produced may be periodically interrupted at an audio —or radio-frequency rate because the time constant R_gC_g of the grid leak and capacitor combination is too large to permit the bias to readjust itself with the rapidity necessary to follow changes in amplitude produced by random effects. Such interruptions in the oscillations can be eliminated by *reducing* the time constant R_gC_g. In practice this means reducing the capacitance of C_g, since the resistance of R_g is fixed by the grid-bias voltage requirements of the tube.

Frequency—and Frequency Stability—of Vacuum-Tube Oscillator

The frequency of the oscillations generated by the vacuum-tube oscillator is not the simple $f = 1/6.28\sqrt{LC}$ of the resonant tank circuit. Actually, the frequency adjusts itself to a value such that the voltage applied to the grid of the tube by the oscillations is of exactly the proper phase to produce the oscillations that supply this grid-exciting voltage. This frequency approximates the resonant frequency of the tank circuit (when more than one resonant circuit is employed in the oscillator, as in the tuned-grid tuned-plate arrangement to be described later, the frequency tends to be controlled by the circuit in which the circulating reactive volt-amperes are greatest). However, it is also influenced by such factors as the voltages acting on the tube, the effective Q of the tank circuit, the harmonics generated, the resistance and reactance coupled back into the tank circuit by the load, etc. All these modifying factors tend to produce small phase shifts between the exciting voltage and the output voltage of the tube, and in order to compensate for these, the oscillator operates slightly off the resonant frequency of the tank circuit in order to introduce the necessary compensating phase shift.

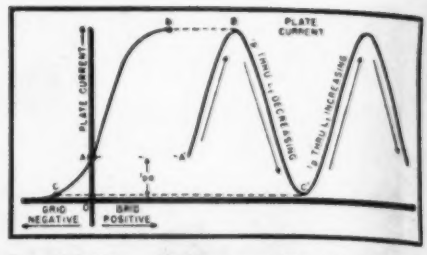


Fig. 2. How plate current flowing through tickler L_1 varies as the grid makes its positive and negative excursions.

In practice, the resonant frequency and the effective Q of the tank circuit are the two most important of the factors affecting the frequency generated by an oscillator. The generated frequency will vary with the resonant frequency of the tank circuit, while the effect of the tube voltages, load impedance, etc., on the frequency are inversely proportional to the effective Q of the tank circuit.

The frequency of a vacuum-tube oscillator may be theoretically determined from the formula:

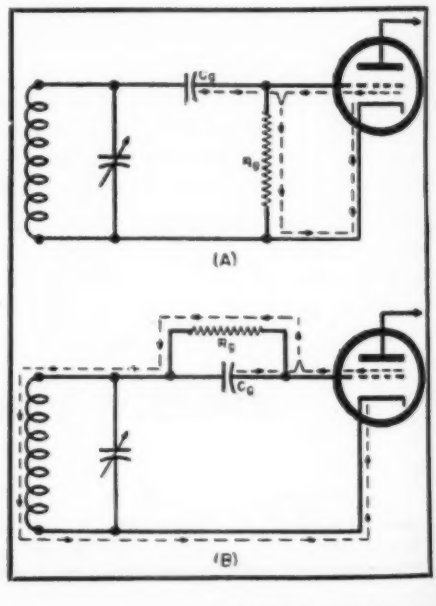
$$f = \frac{1}{6.28}\sqrt{\frac{1 + R/R_p}{LC}}$$

in which R is the total radio-frequency resistance of the tuned circuit (including effect of external reflected load, etc.), and R_p is the internal plate impedance of the tube.

Inspection of this formula reveals that voltage changes on the plate will result in frequency changes, since the plate voltage changes alter the plate impedance, R_p, of the tube. Accordingly, the power supply to the oscillator must supply the necessary plate current without undue "loading," and have excellent voltage regulation.

Further inspection of the formula shows that the effect on frequency of unavoidable variations in tank circuit

Fig. 3. Two methods of connecting the grid leak in the circuit. The dotted lines indicate the leakage path for the grid-trap electrons in each case.



RCA Laboratories model with an 18 by 24-inch screen showing how Bob Hope may appear on future home television.

New Projection Television - Bob Hope's face "big as life"

Can you picture Bob Hope on television ... seeing his face *big as life*—right in your own living room?

Well, you will—for now, thanks to RCA research, all limitations on the size of home television screens have been removed.

RCA Projection Television sets can have 18 by 24-inch pictures, or for that matter, pictures as large as the screen in a "movie" theater!

When you tune in an NBC television broadcast you'll almost think the actors are in the same room with you—and trust NBC, America's No. 1 network in sound broadcasting, to bring you the best in television entertainment.

This revolutionary improvement was achieved in RCA Laboratories by development of an entirely new reflector and lens, shown in phantom above. This lens, of inexpensive plastic, is 8 times as efficient for the purpose as the finest optical lens.

When you buy an RCA radio, phonograph or television receiver—or any other RCA product—you receive the benefit of the latest research development of RCA Laboratories. It is this *plus value* which is your assurance of lasting satisfaction.

The widespread public recognition of this plus value has given to RCA world leadership in the radio, phonograph, television and electronic art.

Dr. D. W. Epstein with a projection television tube, reflector and lens unit. Here the image on the end of the tube hits the reflector, is corrected by the lens, projected to the screen, then enlarged ... making possible larger and clearer television than ever before.

RADIO CORPORATION of AMERICA

PIONEERS IN PROGRESS

RCA

constants (such as variation of L and C as a result of the respective temperature coefficients of the inductor and capacitor, etc.) will be a minimum if the value of fraction R/R_p is a minimum. This calls for use of a small value of R with the maximum value of R_p.

Now, for maximum frequency stability in oscillators it is imperative that maximum Q exist in the tuned circuit. This means that lowest possible radio-frequency resistance must be attained in the design of the tuned circuit. The product LC is constant for any particular frequency of oscillation. However, the same LC product may be attained by various combinations of inductance and capacitance values ranging from the use of low L and high C, to use of high L and low C. Now a tuning coil having low inductance will be smaller physically and thus may be built to have lower ohmic resistance, lower distributed capacitance, and lower radio-frequency resistances than a similar one having high inductance. So, there is a definite advantage in using a low-value of inductance.

The larger value of C required with the smaller inductance will result in using a capacitor that can be built more ruggedly and whose capacitance will be less affected by mechanical shock, vibrations and change of temperature. Since all changes due to such factors will amount to only a *small* total capacitance, they therefore will result in only a small *percentage* change of the total capacitance and frequency!

Additional important aspects of the subject of frequency stability of oscillators employed in superheterodyne receivers will be considered in greater detail in a later lesson.

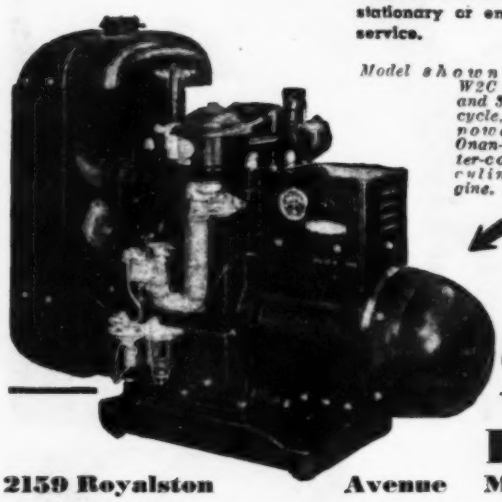
(To be continued)

ELECTRICITY FOR RADIO AND ELECTRONIC APPLICATIONS

• ONAN ELECTRIC GENERATING PLANTS supply reliable, economical electric service for electronics applications as well as for scores of general uses.

Driven by Onan-built, 4-cycle gasoline engines, these power units are of single-unit, compact design and sturdy construction. Suitable for mobile, stationary or emergency service.

Model shown is from W2C series, 2 and 3-KW, 60-cycle, 115 volt; powered by Onan-built water-cooled 2-cylinder engine.



ELECTRIC PLANTS Onan

Models range from 350 to 35,000 watts. A.C. types from 115 to 660 volts; 50, 60, 180 cycles, single or three-phase; 400, 500 and 800 cycles, single phase; also special frequencies. D.C. types range from 6 to 4000 volts. Dual voltage types available. Write for engineering assistance or detailed literature.

Over 200,000 in service

D. W. ONAN & SONS

2159 Royalston Avenue MINNEAPOLIS 5, MINN.

SPEED UP REPAIRS WITH THESE G-C AIDS!

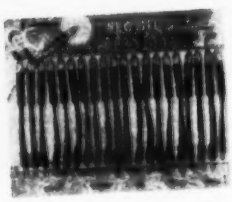
FREE STEEL CABINET

G-C Dial Belt Kits

Exact replacement woven fabric belts. Easy to install — no stretching — no adjustments — a perfect fit every time. Kits come with 25, 50, 100, 200 or 300 belts.

Automatic Wire Stripper

Strips insulation from all types of wire. Does the job instantly, easily, perfectly. An ideal tool for radio men, electricians and sound men.



G-C Ne-O-Lite

New improved design. Useful hundreds of ways. Tests AC and DC lines, DC polarity, fuses, etc. You can't afford to be without this handy all-purpose trouble shooter.

Order From Your Radio Parts Jobber

ALWAYS ASK FOR G-C PRODUCTS

G-C GENERAL CEMENT MFG. CO.

ROCKFORD, ILLINOIS

G.I. Plans Postwar Shop

(Continued from page 47)

banker. He approves the Sergeant's application for a radio shop property loan. Like other veterans who had served a minimum of 90 days active service between September 16, 1940 and the end of the war, he is eligible to apply for a loan under the G.I. Bill of Rights loan provisions. Approval will be forthcoming because the bank knows of his background of previous radio repair shop experience in Southern Illinois before entering the service; his intensive Army training course in the repair of complicated radar and radio equipment before going to France. This experience plus good character recommendations from his C.O. make the Sergeant a good business risk. The loan will be approved by the Administrator of Veterans' Affairs if it meets the requirements of the G.I. Bill—namely that the loan be used for the purpose applied for, that the property is necessary for the radio store, that conditions are favorable for successful operation of a radio repair business, and that the purchase price to be paid for property is not in excess of its normal value. The government guarantees one-half up to $2,000 of a business property loan. In the Sergeant's case with a loan of $4,000, only $2,000 would be guaranteed by the government. As a matter of fact in the Army Service Forces survey, made before the G.I. Bill passed, men replying stated they did not intend to invest more than $4,000 on an initial investment. About 60 percent indicated they had all or at least half of the necessary capital. If additional money was needed one-sixth of the men stated that they planned to borrow from banks and loan companies, and one-tenth counted on making personal loans from their friends.

The State of New Jersey has already handled a total of 151 veteran's business property loan applications aggregating $215,000. Of this total, 125 have been granted while 26 were disapproved by banks as bad credit risks. Standards are not too rigid as only 17 per cent of the applications were rejected, representing about 20 per cent of the total dollar volume in requested loans.

Not taught in a Book!

It takes much more than "Book Learning" to make good wire . . . Our many years of practical experience in meeting the needs of War and Peace explains why Runzel cords, wires and cables have a reputation for quality the world over

Runzel

CORDS • WIRES • CABLES

RUNZEL CORD & WIRE CO.

4723-31 MONTROSE AVENUE • CHICAGO 41

It is obvious that bankers will need outside guidance in approving scores of business loans similar to the one made by the Sergeant for a radio store. Each local community in co-operation with trade and civic groups should make a study to see which new business fields are needed most and which offer an opportunity for success. Perhaps, there will be too many G.I.'s wanting to open a radio store! All G.I.'s may not be as fortunate as the Sergeant. Some may not be judged a good risk. What then? The local guiding agencies may recommend a course in trade or business training in which the government again aids with as much as $500 a year for tuition fees. Or, it may be found that the veteran needs practical experience in a successful store where a series of related jobs will teach the prospective radio proprietor about stock-keeping, records, merchandising, and a score of other phases that go into making a successful store.

Going Broke

What happens if the Sergeant goes broke? In case of failure of his store does the government take it on the chin on its $2,000 guarantee or do the bank and government share the loss equally based on their interest in the loan. Silent as a Sphinx, the government has yet to clarify this point. However, the Veteran's Administration has ruled that a veteran's disability compensation may be attached by the Federal Government if he is unable to keep up his payments on his business property loan. Interest on this loan must not exceed 4 percent and is payable in full in not more than 20 years.

How many radio repairmen are in the service? The Army has a total of 7,700,000 in service. The Navy has a total of 3,300,000. Of this figure, the Army has trained 127,500 enlisted men, 14,600 officers, and 1,900 Wacs in radio operation and maintenance.

As an Infantry Division has 374 operators and 39 maintenance men, an Armored Division 377 operators to 60 maintenance men or a ratio of about 7 to 8 operators for every maintenance and repairman, it would be reasonable to estimate that the Army has around 18,000 to 20,000 qualified radio repairmen. In addition, the Air Corps has trained 20,000 radio operators and maintenance men annually (about 2,500 to 3,000 repairmen) while the Navy has trained 110,000 men with radio ratings of various types. How many of these more than 35,000 radio repairmen will enter the repair business? When we remember the previous survey, three of every ten discharged servicemen indicating interest in going into business for themselves, with 25 percent stating preference for service stores, it is likely that more servicemen will want to enter the radio repair shop field as operators than are engaged in this field in the entire country today.

The Army training, acquired by the Sergeant and typical of the other branches, gives some idea as to the thorough radio training given on-the-job. Training includes almost every type of radio equipment used today: Installation, inspection, testing and repairing of all types of radio transmitting and receiving instruments and equipment including FM, amplitude-modulated, and fixed station.

What are the opportunities in radio repair work for the Sergeant and his buddies? With pent-up demands for new radios, repairs for thousands of sets forced to do their stuff with emergency repairs for the duration, advent of pocket radio, new home and auto sets, there would seem to be plenty of room for expansion in the present ten-thousand-odd radio repair shops to several times this figure, comparable with the number of shoe repair shops. Each person uses three pairs of shoes each year. Why not three radios? Too, for servicemen not possessing the necessary qualities for running their own business, over 50,000 outlets (household appliance, department, furniture, and music stores) handling radios will offer plenty of opportunity for many radio repairmen.

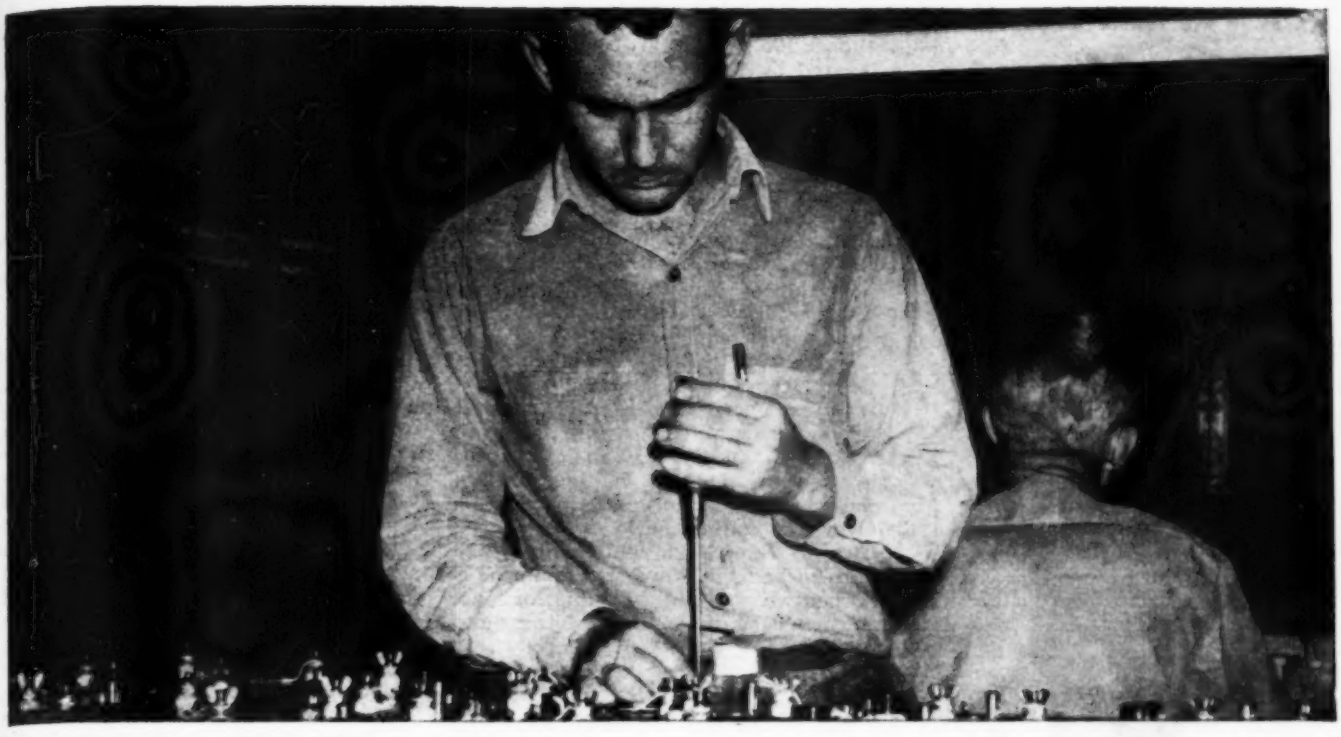
The television field alone will require many men with the type of training and experience Sergeant Brown has had. Even installation of television and FM receivers for best results requires the knowledge of an expert.

Will the G.I. Succeed?

Will the Sergeant succeed in his new radio business? Previous radio experience is a touchstone for success. Charles has that much to his credit already. On the danger side the Department of Commerce reminds veterans that nearly half of the firms going into the red do so because they are operated by men without previous experience in the field they entered. Many veterans are aware of this prerequisite as their letters show: "I have had experience in this line and believe I could make a success of a small business again if I can get a start." Or, "Prior to the war I was engaged in the ——— business and shall appreciate any information you have on this business." The moral is: Choose a business in line with previous Army and civilian experience.

If the Sergeant is wise he will start out by keeping good business records for the Commerce Department again discloses that out of the firms that failed 79 percent neglected to keep adequate records or kept records at all! Dun & Bradstreet studies also show that successful radio stores spend less of their sales receipts on expenses than unprofitable firms. Further reasons for radio store failures are: Too much spent on salaries and wages or for fixing up the store to keep up with John Jones next door. Small business is a dangerous game in which many lose their shirts. In an average year for every firm entering the arena another gives up the ghost and

Operator applying the torque test to cathode-ray tubes at the Dobbs Ferry plant of North American Philips Company, Inc. Tubes (lower right) are soaked in warm water for 18 hours—then the base is inserted in the holder and the tube is twisted against the torque of the weight on the arm. This makes sure that the cement holds firm in the base of the tube. Type 5LP1 tube is being tested, while other tubes, shown immersed, include types 5CP1, 5BP1, and 3BP1.



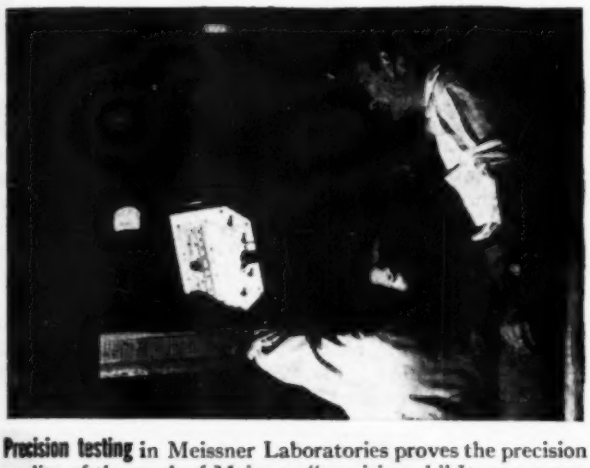
Skilled fingers check every connection before this Meissner electronic equipment leaves Mt. Carmel, Ill., its destination —"Somewhere with the Armed Forces." This "precisioneering" may make the difference between a successful military operation or a defeat, and Meissner's "precision-el" are working for victory.

THIS IS PRECISIONEERING

by Mt. Carmel's famed "Precision-el"

Precisioneering isn't just another word for precision quality. It means that pride and skilled craftsmanship are represented in every product. To the men and women of Meissner, precisioneering means that they are maintaining the same high standards of workmanship that earned them the name "precision-el"—highest standard of an exacting industry.

To you, the users of Meissner precision-built electronic equipment, it means that these precisioneered products give you added quality, greater dependability.



Precision testing in Meissner Laboratories proves the precision quality of the work of Meissner "precision-el." It means new highs in performance when you specify Meissner precision-built electronic equipment for your product.

"Step Up" Old Receivers!

These Meissner Ferrocart I. F. input and output transformers are getting top results in stepping up performance of old worn receivers. Special powdered iron core permits higher "Q" with a resultant increase in selectivity and gain, now available for frequency range 127-206. Ask for numbers 16-5728 input, 16-5730 output. List $2.20 each.

Concentration on the production of finer electronic equipment is characteristic of the men and women of Meissner. This devotion to quality production makes "precisioneering" out of even the most routine jobs—gives even greater skill to technicians like these.

MEISSNER

MANUFACTURING COMPANY • MT. CARMEL, ILL.

ADVANCED ELECTRONIC RESEARCH AND MANUFACTURE

Export Division: 25 Warren St., New York; Cable: Simontrice

Look to the Leader for Leadership

Gothard
NEON
PILOT LIGHT

Neon Lamp Provides
3000 Hour
Continuous Operation
Warm Glow
Visible from All Angles

Uses
Mazda Lamps
NE 45
NE 51
NE 15

The Ultimate in Light Penetration and Diffusion

This Gothard Pilot Light assembly accommodates neon lamps which will burn continuously for approximately 3000 hours, as compared with the approximate 500 hour life of ordinary lamps. It operates on 110 volts and consumes only ¼ watt. The unbreakable lucite protective cap, designed and made for Gothard exclusively, provides perfect light dispersion of the warm neon glow in all directions. Lucite cap unscrews for lamp change. Bakelite socket. Polished and chrome plated jewel holder. 1" mounting hole. Colors: red, green, amber, blue and clear. Ask for complete information on this and wide range of other Gothard Lights.

Gothard
MANUFACTURING COMPANY
1350 North Ninth Street, Springfield, Illinois
EXPORT DIVISION—25 Warren Street
New York 7, N. Y.
CABLES—Simontrice, New York

LEARN
RADIO·ELECTRONICS
TELEVISION, SOUND SYSTEMS, ETC.

"Learn by Doing"
12-WEEKS Training
IN COYNE SHOPS

Train now for a good job and a peace-time future in Radio-Electronics. Free employment service after graduation. Earn while you learn. If short of money, I'll finance your training.

We have facilities for men with physical disabilities. If you have a physical disability of any kind check here ☐ and mail with coupon.

Send coupon today for all details.

H. C. Lewis, Pres., Radio-Electronics Div., Coyne Electrical School, Dept. 42-1K, 500 S. Paulina St., Chicago 12, Ill.
Send Free Book and details of "Pay-After-Graduation" plan.

NAME _____
ADDRESS _____
CITY _____ STATE _____

retires from the ring! Failures are almost 100 percent in the type of shop favored by the Sergeant, that is, the little fellow who operates his own store or hires only a few employees.

Go West, G.I.

Where should the Sergeant decide to locate his radio shop? One business man gave him advice: "Take Greely's advice and 'go West.'" As a matter of fact wartime production demands have changed populations of some states considerably. The West has gained at the expense of the East; Coastal and Great Lakes areas have won residents from the interior. California heads the list for gains while Arkansas, Oklahoma, and Kentucky are at the bottom, having suffered most seriously from loss in population. Over one million servicemen will return to New York while only 10,000 will go back to Nevada. In terms of percentages of total population each State will gain on equal basis, however.[1]

Community Must Aid G.I.

Much remains for the local community to do for the returning G.I., like Charles, to enable him to make a real start in business. Offering G.I. study books and loans as an encouragement to enter business may be an invitation to business suicide. Shysters may pounce on the veteran as a "gold-brick" opportunity to capitalize on loans or stock up his store with a bunch of worthless stock leaving him later to shift for himself. Each community can lay the following groundwork. (1) Have business and civic organizations make an immediate survey to give G.I.'s adequate information on the type of business needed in each community; (2) see that such information is given to local bankers so that sufficient information is available in making an appraisal for G.I. loans; (3) provide additional financial assistance for any sound business venture; and (4) as in the case of Charles, have experienced radio men give him the continued benefit of their experience and not leave him to flounder for himself after opening for business.

Obviously local action must be taken now when veterans are being discharged in ever-increasing numbers. Every radio firm in a community has a personal interest in new firms in that field. The veteran's shop may be the straw that breaks the camel's back. And remember this, real community assistance in aiding the veteran get off to a successful start in business and civilian life will do more to assure him that his fight was worthwhile than all the ten dollar words from Webster that might appear on his shop's foreclosure sign!

[1] Commerce Department officials point out that a veteran should consider his own home town as the most feasible location for his business rather than start from "scratch" in a location where he is unknown.

—30—

Phasing of Loud Speakers

(*Continued from page* 31)

one terminal of the primary has been arbitrarily selected as positive. When testing it is seen that in contact (1) the pointer kicks *up* scale, and when breaking contact (2) the pointer kicks *down* scale. From the previous discussion it is concluded that terminal *a* is positive.

Testing with Oscilloscope

This is a rapid and safe method, wherein very low exciting voltages may be used. The connections are shown in Fig. 4. The preliminary step is to use connection (1) to determine the "in phase" pattern. Since the same voltage is applied to both sets of plates, the trace will be a straight line. With equal horizontal and vertical amplitudes, the line will be inclined either 45° or 135°. The 45° position is considered standard, but in either case an "in phase" reference position is established.

The next step is to change horizontal input connection from point (1) to point (2). (Readjust for equal horizontal and vertical amplitudes.) If the straight line trace is inclined at the same angle as for the "in phase" connection, then terminal *a* is positive. (The designations "vertical" and "horizontal" may be transposed to utilize the higher gain of the vertical amplifier.)

Summary

Proper reproduction of sound from multiple speakers requires that all diaphragms move simultaneously "in phase." Arbitrarily, we may choose outward motion as positive. Then the positive terminal of the voice coil is the terminal to which positive voltage is applied to produce positive (outward) motion.

Transformers are to be polarized and marked so that the current shall flow, in effect, in at the primary marked terminal and out of the secondary marked terminal. When speakers and transformers have been so marked, they may be interchanged without risk of upsetting phase relations. As has been seen, various simple methods of checking transformer polarity are available.

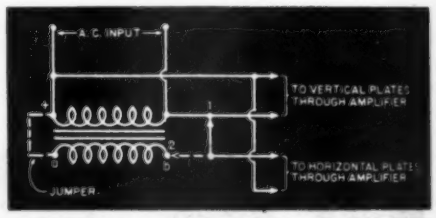


Fig. 4. Method of employing an oscilloscope when determining proper phase polarity.

Manufacturers and users of sound equipment are urged to polarize transformers where proper application involves correct phase relations.

—30—

meets special applications

saves time . . . saves tooling . . . speeds delivery!

If your application requires a specially designed relay Guardian engineers can be of great help to you. But, as a result of their wide experience in designing "specials" they have evolved a standard design so flexible that it is now specified in numerous applications that would ordinarily require a specially designed unit. Perhaps you can use it in your "special" application . . . with a saving in money and delivery time. This unusually flexible relay is the SERIES 345. Its chief features are the large coil winding area, numerous contact combinations, the non-binding pin type armature hinge pin, its resistance to shock and vibration, and an ability to operate in extremes of temperature. It is now being used in aircraft, radio, and other exacting applications to insure dependable performance.

STANDARD SERIES 345—The ample coil winding area of the SERIES 345 gives you a wide range of windings for various voltages and currents. Coil winding area is approximately .75 cubic inches. Average power required is 3.56 watts with three pole, double throw contacts of 12½ amp. capacity. Coils are available for either A.C. or D.C. operation.

The maximum switch capacity of the Standard Series 345 is three pole, double throw. Contacts are rated at 12½ amperes at 110 volts, 60 cycles, non-inductive A.C. Moving contacts are attached to but insulated from the armature by a bakelite plate. Terminals are solder lugs. Weight is 6½ ounces.

VARIATIONS OF THE SERIES 345 RELAY

TIME DELAY

WINDING—Multi-wound coils are available for operation on two or more circuits. Or coil may be wound to operate on the discharge of a 3 mfd. condenser.

CONTACTS—Normal switch capacity is three pole, double throw; maximum switch capacity may be up to six pole double throw with 12½ amp. contacts, or any variation of contact combinations within this range, including the operation of contacts in sequence. The flexibility of the contact springs may be increased through the use of coil spring rivets.

TIME DELAY—On D.C. coils a time delay of 0.25 seconds on release or 0.06 second on attract may be achieved through the use of copper slugs which require these time intervals for saturation or de-energizing depending on whether they are used on the heel or head of the coil.

DUST COVER—For applications where this relay may be subject to injury or in atmosphere where dust may be present in sufficient quantity to impede operation, the SERIES 345 may be equipped with a metal dustproof cover.

SCREW TERMINALS—Screw type terminals are optional for applications where terminals must be disconnected occasionally or where solder lug terminals are not otherwise practical.

DUST COVER

INTERLOCKING—The SERIES 345 may be used in combination with various coils to achieve a mechanical interlock. One of the most recent developments is the use of the SERIES 345 in an overload application. Excessive current energizes the SERIES 345 coil. The armature is then mechanically locked in the energized position by an arm attached to a Series 405 coil and is held in the locked position until the Series 405 coil is energized by a push-button arrangement. If current through the Series 345 is still excessive, relay remains in locked position even though released by push-button control.

INTERLOCKING UNIT

SERIES 345 RELAY DATA

Normal Volts	Minimum Volts	Normal M.A.	Minimum M.A.	Coil Resist.	Normal Wattage
6	4.8	600	480	10	3.56
12	9.8	300	245	40	3.56
24	18	148	111	162	3.56
32	25.6	112	89	287	3 56
115	92	31	25	3720	3.56

Minimum operating wattage.....2.3

If you will write us about your relay problems our engineers will be glad to make recommendations which may save you time and money. Should you desire a quotation, please mention quantity.

GUARDIAN ELECTRIC

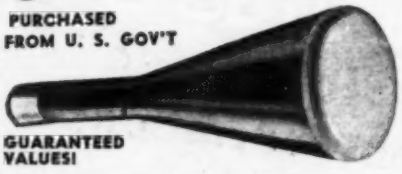
1630-D W. WALNUT STREET CHICAGO 12, ILLINOIS

A COMPLETE LINE OF RELAYS SERVING AMERICAN WAR INDUSTRY

WAR SURPLUS BARGAINS

CATHODE RAY TUBES

PURCHASED FROM U. S. GOV'T



GUARANTEED VALUES!

A find for experimenters and Hams. Standard 5 inch cathode ray tubes. Nos. 5BP1 or 5BP4 ideal for scope, television and experimental work. Slightly used by U. S. Gov't. for test work. Guaranteed to give excellent service. Bargain list of other tubes on request. Specify number when ordering.

5 INCH, TYPE 5BP1 or TYPE 5BP4. Each, Ex. col. EACH ONLY $12.00

HEADPHONES

They're hard to get but we've got 'em. Made for use in tank corps helmets. 4000 ohms. With moisture proof cord and phone plug. Express collect.

PER SET $2.95

TWO MICRO-AMP METERS IN ONE

A "buy" for radio servicemen and experimenters in radar, electronics and television. Actually two meters in one. First movement has zero center with 100-0-100 micro amp. range. Second movement has 0-200 micro amp. range. Luminous pointers. Accurately calibrated scale furnished with each meter. Calibrated dial may be superimposed on face of meter. Zero adjustments. Original cost $40.00 or more.

EACH EXPRESS COLLECT..... $9.85

WAR SURPLUS BARGAIN BOOK

Page after page of war surplus and other bargains for home, shop and outdoors. Write to-day! It's FREE!

FREE CATALOG

STARK'S Dept RN4 509 So. STATE STREET CHICAGO 5, ILLINOIS

LEARN ELECTRICITY

12 WEEKS SHOP TRAINING

"LEARN BY DOING" IN COYNE SHOPS

Electricity offers you opportunities for the best jobs today—with a real peace time future. "Learn by Doing," on real machinery. Earn while learning. Right now I'm offering extra training in Industrial Electronics at no extra cost. Lifetime employment service after graduation. Get all-around practical training at Coyne in 12 weeks. If you are short of money I'll finance your training. Mail coupon now for Free Book. We have facilities for men with physical disabilities. If you have a physical disability of any kind check coupon below for details.

H. C. Lewis, President, COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Dept. 45-81, Chicago 12, Illinois
Send free book and all details. ☐ Send physical disability plan.

NAME _____

ADDRESS _____

CITY ZONE STATE

Ted McElroy

World's Largest Manufacturer of Wireless Telegraphic Apparatus

COMPLETE CENTRAL OFFICE EQUIPMENT

McElroy Manufacturing Corp.

82 Brookline Avenue • Boston, Massachusetts

Manufacturers' Literature

Readers are asked to write directly to the manufacturer for the literature. By mentioning RADIO NEWS, the issue and page, and enclosing the proper amount, when indicated, delay will be prevented

NORTH AMERICAN FOLDER

A new folder covering the *Norelco* Geiger-Counter X-ray Spectrometer has been recently issued by the *North American Philips Company.*

This instrument, which was announced by the company recently, is the first Geiger-Counter focusing spectrometer to be developed and the instrument is applicable to process control in the paint, chemical, ceramic, rubber, and metallurgical fields.

The unit provides an entirely new method of making quantitative and qualitative analyses of crystalline and certain amorphous substances. Under optimum conditions of resolution, accuracy of ±.03 of a degree is obtainable.

Descriptive material included in the folder covers methods of operation and specifications of the spectrometer, transformers, stabilizer, scaling unit, power supply, frequency meter, impulse counter, Geiger unit, and X-ray tube.

Copies of this bulletin are available on request to *North American Philips Co., Inc.*, 100 East 42nd Street, New York 17, New York.

HAINES RESISTORS

The new 1945 catalogue, printed in color, now is available for distribution to the public, according to the announcement made recently by the *Haines Mfg. Corporation.*

This catalogue is prepared in such a manner as to simplify the task of ordering resistors for specific jobs. Wirewound resistors of several types are illustrated and ratings, characteristics, and prices are included to assist in the proper selection of these components.

Requests for the catalog will be cared for promptly when they are directed to the company, *Haines Mfg. Corporation,* 246 McKibbon Street, Brooklyn 6, New York.

CAPACITOR CATALOGUE

In order to provide designers, experimental engineers, and production executives with a practical working selection of ceramic capacitors, the *Electrical Reactance Corporation* has prepared a handbook that contains 81 standard rating ceramic capacitor samples.

In addition to actual working samples, this catalogue includes plant illustrations which show the manufacturing processes and testing methods including the application of solid silver for condenser plates, which the manufacturer claims is nonaging, noncorrosive, and maintains excellent conductivity. The A.S.A. Color Code is included in this handbook for reference purposes.

Distribution of this catalogue is limited to designers, experimental engineers, and production engineers. Write for copies of this catalogue on company letterhead to *Electrical Reactance Corporation,* Franklinville, New York.

ELECTRONICS BOOKLET

A 32-page, nontechnical guide book designed to assist executives answer the question "Can Electronics Improve Your Product?" is being distributed by *Operadio Mfg. Company.*

This guide book provides practical information regarding the company's facilities and capacity for the production of electronic subassemblies and parts. Engineering and production facilities are fully described.

Distribution of this booklet is limited to business and industrial management executives and will be sent to qualified persons upon request to *Operadio Mfg. Company,* St. Charles, Illinois.

BERYLLIUM BOOKLET

Information on the physical properties of some beryllium-copper alloys is contained in a new catalogue released by *Beryllium Corporation* of Pennsylvania.

Recommendations on heat treatment, machining practice and descriptions of parts that have been made in beryllium-copper are also included. This catalogue should be of interest to those in the industry, inasmuch as this represents the first comprehensive treatment of the subject.

Copies of the booklet entitled, "Berylco Beryllium-Copper Castings" will be forwarded to those requesting it from *The Beryllium Corporation of Pennsylvania,* Reading, Pa.

PLUNGER RELAYS

The new series of normally open mercury plunger relays is described in Bulletin "D" of the *H-B Electric Company.*

The new relay design which more than doubles the effective length of the magnetic plunger with only one-quarter of an inch increase in the over-all length of the mercury tube covers four different types.

Engineering and mechanical data regarding this equipment is included for the benefit of the user in ordering.

Copies of Bulletin "D" will be sent

—*Your Microphone is here*

As outstanding manufacturers of microphones for war —Shure offers a complete microphone line. You will find the proper microphone for every need above. A complete description of any model will be furnished upon request.

A. Super-Cardioid Broadcast Dynamic
B. Unidyne Cardioid Dynamic
C. Uniplex Cardioid Crystal
D. Stratoliner Dynamic
E. Laboratory Non-Directional
F. "Economy" Crystal
G. Lapel Microphone
H. Military Carbon
I. Throat Microphone
J. Carbon Hand Microphone
K. Mask Microphone
L. Stethophone
M. Vibration Pick-up

SHURE MICROPHONES

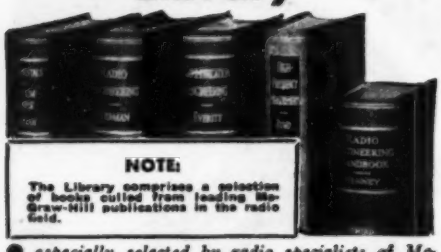
SHURE BROTHERS

Designers and Manufacturers of Microphones and Acoustic Devices

225 West Huron Street • • • Chicago 10, Illinois

NOW—A REALLY HIGH-POWERED—

Radio Engineering Library



● *especially selected by radio specialists of McGraw-Hill publications*

● *to give most complete, dependable coverage of facts needed by all whose fields are grounded on radio fundamentals.*

● *available at a special price and terms*

THESE books cover circuit phenomena, tube theory, networks, measurements, and other subjects—give specialized treatments of all fields of practical design and application. They are books of recognized position in the literature—books you will refer to and be referred to often. If you are a practical designer, researcher or engineer in any field based on radio, you want these books for the help they give in hundreds of problems throughout the whole field of radio engineering.

5 VOLUMES, 3559 PAGES, 2558 ILLUSTRATIONS

1. Eastman's FUNDAMENTALS OF VACUUM TUBES
2. Terman's RADIO ENGINEERING
3. Everitt's COMMUNICATION ENGINEERING
4. Hund's HIGH FREQUENCY MEASUREMENTS
5. Henney's RADIO ENGINEERING HANDBOOK

10 days' examination. Easy terms. Special price under this offer less than books bought separately. Add these standard works to your library now: pay small monthly installments, while you use the books.

10 DAYS' FREE EXAMINATION—SEND COUPON

McGRAW-HILL BOOK CO.,
330 W. 42nd Street, New York 18, N. Y.

Send me Radio Engineering Library, 5 vols., for 10 days' examination on approval. In 10 days I will send $3.00 plus few cents postage, and $3.00 monthly till $24.00 is paid, or return books postpaid. (We pay postage on orders accompanied by remittance of first installment.)

Name .....

Address .....

City and State .....

Position .....

Company RN-4-45

IF YOUR SPEED IS LESS THAN 50 W.P.M.
SEND TODAY FOR THIS 52 PAGE FREE BOOK
—FOR AMATEURS AND COMMERCIAL RADIO OPERATORS
CANDLER SYSTEM BOOK of FACTS

It shows that "crack" operators rely on something besides practice to develop their high speed and proficiency; it explains the "knack" of sound-sense and sound-consciousness—the secret of speedy sending and receiving. Once you acquire these mental processes, reading code becomes almost second nature to you, just as the rhythm of a dance band becomes automatic to musician and dancer.

Champions endorse the Candler System. It is used in training Commercial Operators, Amateurs, and Radiotelegraph Specialists in Signal Corps, Marines, Navy, Coast Guard, Airlines, Broadcast Studios, Police Inter-City Communications. Wherever the fastest, most efficient operators are found, there you will find Candler trained men.

If you want s-p-e-e-d, if you have any difficulties in operating technique, if 40-50, and more, wpm seem fantastic speeds to you—send for this revealing 52 page Book now. It's yours without cost or obligation. Simply send your name and address to—

CANDLER SYSTEM COMPANY

Dept. 2D, Box 928, DENVER, COLO., U.S.A.
And at *121 Kingsway, London, W. C. 2, England*

upon request to *H-B Electric Company*, 6122 N. 21st Street, Philadelphia 38, Pa.

COMAR PRODUCTS

A two-color, four-page booklet in which are described the company's line of relays, switches, condensers, coils, and other products has been issued by the *Comar Electric Company*.

Specific applications of the company's equipment are highlighted in this circular, copies of which will be forwarded without charge upon request to *Comar Electric Company*, 2701 Belmont Avenue, Chicago 18, Illinois.

COMPONENT CATALOGUE

A new 32-page catalogue, No. 14, has just been released by *Howard B. Jones Company*.

It illustrates and describes the company's complete line of multicontact plugs and sockets, terminal strips and fuse mounts.

Complete dimensional data on all items is given to simplify ordering of merchandise.

A request to *Howard B. Jones Company*, 2460 W. George Street, Chicago 18, Illinois, will bring a copy of catalogue No. 14, promptly.

BALLAST CATALOGUE

A 16-page catalogue covering the Bestran Ballasts for fluorescent units has been issued by the *Hudson American Corporation*.

All of the standard models of the ballast are illustrated and specific data and dimensions are tabulated for ready reference. Installation and operating techniques are demonstrated and actual installations of the equipment are pictured.

The application of this equipment on production lines and in reducing rejects in war plants is given careful attention.

Requests for this catalogue will receive prompt attention when such requests are addressed to *Hudson American Corporation*, 25 West 43rd Street, New York 18, N. Y.

"QUALITY CONTROL"

A new pocket size handbook on scientific inspection has just been released under the title "Quality Control" by *Continental Machines, Inc.*

Over 200 photographs, diagrams, charts and tables make the explanation of scientific inspection interesting, absorbing and informative. Of particular interest are the conversion tables and measuring data which give pertinent information for the precision measuring methods required in scientific inspection.

One section contains thirty-five subjects vital to quality control which are highlighted with examples showing how to use precision measuring instruments. Among the precision instruments and methods shown for quality control are the new mobile inspection units, sine bars, vernier gages, optical flats, comparator gages and others. Another section of the handbook contains 64 questions for self-testing.

This book is designed for plant inspection departments and provides many ways of checking new ways to establish quality control.

This 140-page book is available to qualified persons upon request to *Continental Machines, Inc.*, 1301 Washington Avenue South, Minneapolis 4, Minnesota.

UTC FILTERS

An engineering data sheet on the *United Transformer Company's* new line of low- and high-pass filters is now available for distribution.

This new series of filters is designed to pass a wide band of frequencies above or below a specific point.

Copies of this data sheet, containing dimensions, prices, and other pertinent material will be forwarded upon request to *United Transformer Company*, 150 Varick Street, New York 13, New York.

RECEIVER BOOKLET

A dealer brochure entitled "The Line Dealers Designed" is being distributed to radio retailers by John Meck Industries.

This 16-page booklet contains illustrations and descriptions of postwar radio designs and a plan for distributing and selling radios through radio service and retail dealers. The booklet was prepared from information secured in a national survey in which prospective buyers were asked for their ideas regarding postwar receivers.

Space is provided for imprinting the dealer's name on the back. *John Meck Industries* of Plymouth, Indiana, will forward complete details and copies of the brochure to radio retail dealers.

MAGNAVOX BOOKLET

In the interest of stimulating active participation in music, *The Magnavox Company* commissioned Sigmund Spaeth, renowned music critic, to prepare a book for the guidance of parents.

In this 32-page booklet, Mr. Spaeth has made suggestions regarding the musical education of children from birth, by means of their hearing recorded music, the parents' singing, or through active participation.

Mr. Spaeth has prepared a progressive list of records for use in training the child musically. He emphasizes that a child does not have to be a musical prodigy in order to benefit from a sound musical education.

Various models of *Magnavox* radiophonograph combinations are illustrated. Copies of this booklet may be obtained free of charge from any *Magnavox* dealer, or from *The Magnavox Company*, Fort Wayne 4, Indiana, at a charge of 10 cents per copy.

—30—

SYLVANIA NEWS
RADIO SERVICE EDITION

APRIL — *Published in the Interests of Better Sight and Sound* — 1945

A large, attractive, three-color display banner featuring the phrase "Complete Radio Service" is now ready for distribution to servicemen by Sylvania Electric.

The banner, pictured below, measures 46 by 28 inches; is printed in black, green and white on special weather-proofed "ducking" material making it suitable for use either inside or outside

of the store. It has six metal grommets to provide extra reinforcement.

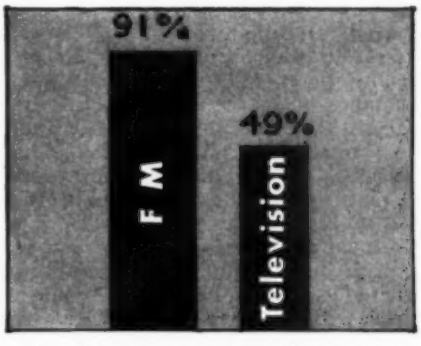
This useful, durable and attractive display banner may be obtained for only $.40 (three for $1) from your local Sylvania distributor, or from Frank Fax, Sylvania Electric Products Inc., Emporium, Pa.

This newest display is another in the extensive list of Sylvania promotion material designed to help servicemen merchandise both their own service and the Sylvania products they sell.

Present Set-Owners Rate FM First In Current Sylvania Radio Survey

91% of Consumers Interviewed Say They Want This Feature In Postwar Receivers

Preliminary reports of the nationwide survey being conducted by Sylvania Electric indicate a high degree of public interest in frequency modulation. Of the thousands of set-owners who have been interviewed, 91% have indicated their desire to have FM incorporated in their postwar receivers. 70% say they are willing to pay an additional sum in order to get this feature.



Graph shows percentages of set-owners stating that they want FM and television in their postwar sets.

Television, while also a subject of considerable interest, ranked behind FM in the tabulation of survey results. 49% of those interviewed stated that they wanted television reception after the war. The same percentage indicated their willingness to pay extra for it.

"Would you be willing to go as high as $300 to have FM and television included in your radio set?"

Service Aspects

This expression of popular interest in frequency modulation suggests the probability that servicemen, after the war, will find the FM feature increasingly common in the sets they will be called on to repair.

Results of other phases of the set-owner survey are now being tabulated, and findings will be published in future issues of SYLVANIA NEWS.

Survey Continues

While the analysis of the results of personal interviews is going on, Sylvania is continuing its survey, and broadening its scope, through the medium of a series of questionnaire-type advertisements appearing in leading national magazines.

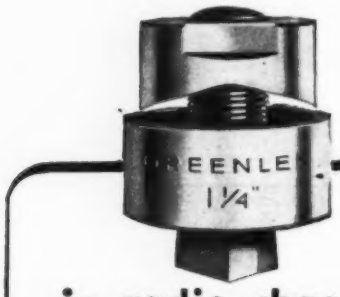
The purpose of these advertisements is to gather additional information on consumer preferences and interest in various types of radio and television receivers. This Sylvania research should be helpful to servicemen in their postwar planning.

SYLVANIA ELECTRIC

SYLVANIA ELECTRIC PRODUCTS INC., *Radio Division,* Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, ACCESSORIES; INCANDESCENT LAMPS

CUT HOLES FAST



in radio chassis

No tedious drilling... no reaming.. no filing! Saves hours of work. Cuts clean, accurate holes for sockets, plugs, other receptacles. Tool has three parts: *punch* cuts through chassis, *die* supports metal and prevents distortion, *cap screw* is turned with wrench to cut hole. Sizes for holes ¾" to 3½". For complete information write Greenlee Tool Company, 1884 Columbia Ave., Rockford, Illinois.

WRITE FOR FREE FOLDER S-119 ➧

Again, when the war is won, we will be on call

. . To DESIGN, DEVELOP and MANUFACTURE . .

Radio Receivers and Transmitters
Industrial Electronic Equipment
Airport Radio Control Equipment
Marine Radio Telephone Equipment

Your inquiries will receive immediate action

ISLIP RADIO MFG. CORPORATION

ISLIP, L. I., NEW YORK

····· LETTERS ·····

FROM OUR READERS

POSTWAR RECEIVER DESIGN

"JUST another letter from a reader regarding postwar home radios. Knowing of no other way to reach manufacturers collectively, I am resorting to your columns if you see fit to print this.

"All that I have to say is only too well-known to the trade and also to a surprising number of set owners with no interest in radio other than in the role of a listener.

"This is directed to those who have plans for producing a quality home radio that will sell for enough for the buyer to expect the best in performance. Speaking in general, it was apparent that up to about 1938, all manufacturers would announce new models that were a definite improvement over previous models and the performance of these sets bore this out. Thereafter, it seems that there must have been a race among manufacturers to see who could have the most gadgets and high-sounding terms to attach to their products which were absolutely meaningless. Their performance dropped at the same time and although one purchased a console large enough to hide a grand piano, the chassis was likely to be of microscopic size and the performance that of a midget receiver.

"There is definitely a market for quality home radios that have not omitted antenna coils and replaced them with condensers. A selective r.f. or preselector stage with good gain that shows some image rejectivity is needed. An oscillator that will not drift unnecessarily or be pulled by a strong signal is another "must." Enough precision in inductances and tuning condensers that gain will be decently uniform across all bands. If short-waves are included, it should not be necessary to advance audio gain to near maximum to get results on short-wave. Properly designed sets do not require an appreciable advance in gain to offset unavoidable losses at the higher frequencies, and certainly not to the point of running audio wide open or nearly so. Just a sprinkle of high dielectric throughout the set would also be desirable to help offset the above condition and keep tuned circuits on the beam. These large consoles should also have a decent audio system that would not depend on a single pentode for output as that definitely cannot be associated with high-quality output. Why one by-pass for all circuits that are similar should be tolerated rather than individual by-passes, is more than I can understand and why the by-passes cannot be located at closest points they by-pass rather than being placed on a board from 6" to 12" away, is not understandable.

"Dial drives that do not require 2 yards of cord and a maze of pulleys that would astound Rube Goldberg. The cord itself could be of a quality that would not require frequent replacement as many sets made 10 years ago still have original cords. A little shielding here and there would also help keep out those unwanted signals and force all signals to arrive over the antenna post rather than throughout the wiring system with the resultant 'birdies,' squeals, and other objectionable reception.

"This could be extended considerably but if these principal offenses were eliminated, there would most certainly be a ready market for such a radio as a considerable portion of the buying public knows a good receiver when they operate it and especially if they are paying a good price for it. Many such radios were manufactured prior to 1939 which proves that it can be done and I sincerely hope that manufacturers of high-quality home radios will see fit to place such radios on the market when production is again resumed."

ESCA FORGY,
McCamey, Texas.

We think the manufacturers would welcome suggestions from our readers on how the postwar receivers might be improved. How about forwarding your suggestions, readers?

* * *

PRICE INCREASE

"AS AN amateur and a great reader of your magazine, RADIO NEWS, I want to compliment you on the progress you have made during the past years of publication.

"There must be an error in the printing of the November issue as it is marked '35 cents in the U.S.A. and 40 cents in Canada.'

"I hope that you can give me some information on this; has the price been raised?"

L. M. THEORET,
Montreal, Quebec.

Yes, that's right. RADIO NEWS *is now 35 cents in the States and 40 cents in Canada on the newsstands. However, the subscription rate is only $3.00 a year in U. S. and $3.50 in Canada.*

* * *

MR. BECKER'S ARTICLE

"I CANNOT let the statements from men in the Armed Forces, taking issue with Mr. Becker, go unchallenged.

"In this, as in all questions, there are two sides to the issue and in this case both sides have their merits. Letters referred to were in the January issue of RADIO NEWS.

"PFC Miles V. Wolhowe feels that

Ever see a Mold with Invisible Cavities?

WE USED TO MOLD 96 switch housings in an 8 hour shift with this mold. Now we turn out 200—all with the same 14 inserts. The plastic material is cured better than before. We use the same press. It's like having a couple of extra cavities you can't see.

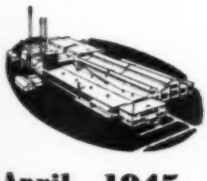
That's what Heatronics (radio-frequency preheating) has done for one of our jobs. For others, it has allowed thicker wall sections—lower molding pressures (sometimes on lighter presses)—more simplified processes. It has even made feasible new applications that we used to shy away from before.

So this is a good time to re-assess your molding program in the light of what Heatronics can do for you. We can help with this at Kurz-Kasch because we've gone into Heatronics more thoroughly than most. In fact, we began with the *first* RCA unit, and now have one of the largest, fastest-growing installations in the industry.

More important, we've had the type of experience that comes from sharing in Heatronics development. We can apply to your problem every advantage that it offers today. With our 28-year-old name for leadership in the plastics industry—plus one of the largest, best-equipped custom plants in the country—that is just one more reason to see Kurz-Kasch first for plastics. Ask for an engineer.

THE WAR BONDS YOU KEEP ARE THE BONDS THAT COUNT

Kurz-Kasch



For over 28 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1429 South Broadway, Dayton 1, Ohio. *Branch Sales Offices:* New York • Chicago • Detroit Indianapolis • Los Angeles • Dallas • St. Louis • Toronto, Canada. *Export Offices:* 89 Broad Street, New York City

A PERMANENT MAGNET UNIT

This famous MODEL 7 permanent magnet driver unit is ideal for most high-power sound projection installations. The unique magnetic structure employs a central cone-shaped magnet of ALNICO, weighing 3 lbs. 4 oz. with a flux strength of 12,000 gausses in the magnetic gap. Will not depreciate in strength through shocks nor ageing. Specifications: 16 ohms impedance; 18 to 20 watts continuous duty.

If you have an idea or a problem we offer you these facilities:

- **Development**
- **Design**
- **Engineering**
- **Precision Manufacturing**
- **Marketing**

*Your Post War Inquiries Invited.

ROWE Industries

ELECTRONICS DIVISION

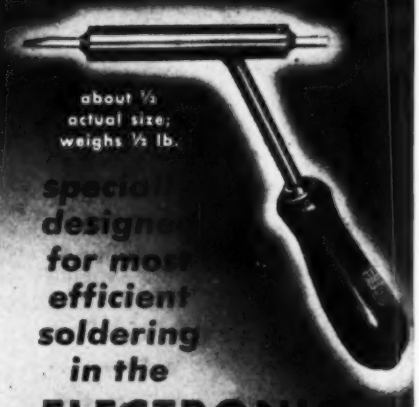
3120 Monroe Street, Toledo 6, Ohio

The IMPROVED

KELNOR

REG. U. S. PAT. OFF.

electric SOLDERING IRON



specially designed for most efficient soldering in the

ELECTRONIC, RADIO AND INSTRUMENT manufacturing and repairing fields

Easily solders hard-to-reach connections. Cuts down fatigue, increases accuracy.

ORDER FROM YOUR JOBBER, OR DIRECT. GENERAL OFFICES: CENTRAL TOWER, SAN FRANCISCO 3

KELNOR MANUFACTURING COMPANY

after 8 months in an Army radio school that he is capable of fixing any radio he (Mr. Becker) has in the shop, etc. Well, I don't blame PFC Wolhowe for being proud of this training. He has every reason to be, but I cannot agree with him that 8 months training in *any radio school* is sufficient to warrant such a statement.

"T. Bullockus 'shudders to think of the thousands of sets from walkie-talkies to SCR-284 (why not the SCR-299) that would be inoperable if Armed Forces technicians were as you pictured.'

"In my opinion the whole thing boils down to what I have contended for years, *i.e.,* the difference between technical training and practical experience. For years I have contended that practical experience is more necessary to the successful operation of a radio service business than any amount of technical training.

"Further, I contend that Army radio training is o.k. for Army equipment, but how, may I ask, would either PFC Wolhowe or Mr. Bullockus get on with a multitube, multiband set with a.f.c., a.v.c., and other so-called refinements, unless they had had previous experience on the set. I think that both would be 'just as lost' as I would be if I were told to locate and replace a shorted by-pass condenser in the radio equipment of one of the B-29's. (Besides being in the service business for over 20 years, I have also held an FCC radio-telephone license 1st class for fourteen years.)

"Mr. Bullockus shows his total lack of experience and knowledge of the radio service business when he takes issue with Mr. Becker for charging '$3.85' for installing a 35Z5 tube instead of selling it over the counter for 85 cents. He doesn't know that to get any 35Z5's at all, we are in most cases paying full list prices for them, plus sales tax, and that nine times out of ten, if a customer is sold a tube over the counter, he will put it in a set that has a shorted filter condenser and blow the new tube and then come running back to the dealer demanding a new one, and if he doesn't get it, he never ceases to tell everyone what a 'gyp' the radio serviceman is.

"It takes from 30 to 45 minutes to remove the chassis from the cabinet, check all the tubes, check alignment, which is usually off after months of service, realign the speaker cone which is usually dragging, take up the slack in the dial drive cable, clean dust and corrosion from the tuning condensers and trimmers, chase out a colony of bugs, and I mean *bugs* that can run like striped zebras, and maybe a mouse nest or two, and if all that isn't worth $2.00 or $3.00 plus parts used, then I am in the wrong business and have been all these years.

"I, too, am a graduate of an Army radio school and was an instructor in radio with the Air Forces in France during World War I (and it was just as hard to us then as it is to you fellows now) and I know that no matter how much technical training you have, you must have plenty of practical experience to successfully service the hundreds and hundreds of different makes, models, shapes and sizes of home radios, and you can't get that experience in the matter of months.

"To you fellows in the Armed Forces now, and thinking of going into the radio service business after your return to civilian life, I would like to say, 'don't start out trying to outdo your competitor by cutting prices and all manner of underhanded methods. Get paid for what you do and what you know. Turn out a good job and work with a view to getting a big backlog of that stuff you will need more than anything else—customer confidence."

E. M. PACE,
Pace's Radio Service,
Vicksburg, Mississippi.

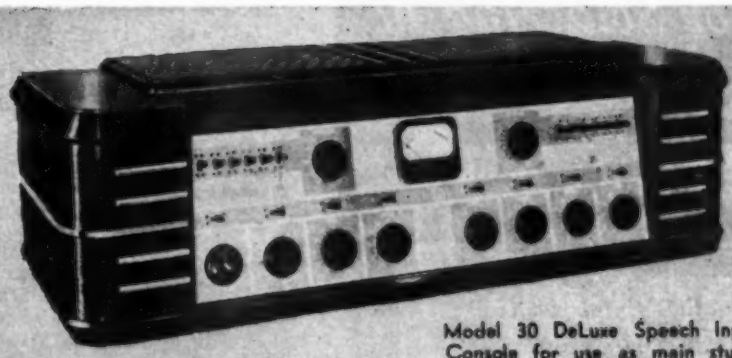
"JUST picked up the January issue of RADIO NEWS. Read just as far as the letters by PFC Miles V. Wolhowe and T. Bullockus, and then exploded. As to the letter from Bullockus, I will hope and pray that he moves to the Middle West and sells tubes over the counter. Being on the eastern seaboard, he can have no idea of the difficulties in getting enough tubes for service, much less to supply an 'extra' set to hoarders.

"As to the letter from PFC Wolhowe —I do not know how much pre-Army school radio that he had, but if he previously held amateur status and operator's license or was engaged in radio service as a vocation, then he will perhaps be one of 'The best radio servicemen we have ever had.' If the PFC was not one of the above mentioned then he is in for the biggest surprise of his life. I have been *repairing,* not fixing radios for the past 13 years and am not the least bit worried about any postwar 'Hot-Shots.'

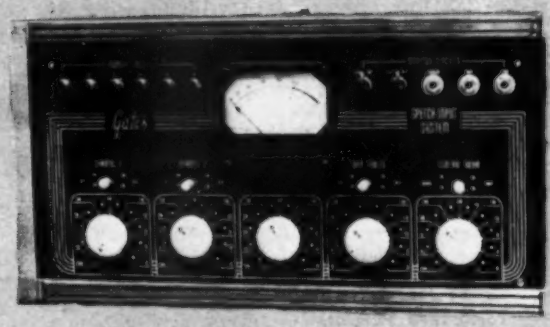
"Let us go a bit farther. My radio experience goes back to the days of loose couplers, two-slide tuners, single-circuit regenerative and others of the early 20's. I still hold class 'A' amateur and radio-telephone licenses and will say that I find that some of the BC sets can be 'tough.' Now, if the PFC is as good as he said in his letter, he has a darn good job waiting for him in my shop. In fact, he can have full control of the service department. But, having taught for two years in an Army radio school, I hardly believe he could fill the bill. Do not get the impression that I do not think well of the Army schools as they are A-1 and I don't mean perhaps. The only thing is that the boys just don't take to it, as a rule. They are exposed to a very fine course in theory and some practice, but the SCR's just aren't broadcast receivers, and all this instruction on them does not make you a radio serviceman. Radio just isn't learned in 8 months, you never learn it all.

"To the radio servicemen, I might say that some of you are making a

Only Gates Offers You This Choice of SPEECH INPUT CONSOLES



Model 30 DeLuxe Speech Input Console for use as main studio control unit for stations up to 50,000 watts.



Model 51 CS Studiette Speech Input Console for smaller stations and sub-studio operation.

● Here are two popular examples of how Gates equipment is *engineered for efficiency and economy* to meet the requirements of every type of station. These two popular studio control units meet every demand for use as a main studio control unit, as sub-studio control equipment, for auditorium pick-ups and for large broadcasts such as symphonies, conventions, .etc. You'll find these Gates units in service all over the world . . . time-proved by dependable service in more than 100 U. S. broadcasting stations ranging from 250 to 50,000 watts.

THE MODEL 30 CONSOLE **is streamline-designed for real showmanship by one of America's leading industrial designers, and carefully engineered to combine these important features:**

- **FM frequency response**
- **5 complete pre-amplifiers**
- **Dual program and monitoring amplifiers instantly interchangeable**
- **All circuits controlled by keys (no push-buttons employed)**
- **Illuminated VU meter**
- **Massive modernisitc appearance**

THE MODEL 51-CS STUDIOETTE **is a junior size of the Model 30, substantially lower in price and ideally suited for the moderate-size station, where quality control equipment with the following features is desired:**

- **FM frequency response**
- **High gain and low distortion**
- **Accommodates 5 microphones, of which any 3 may be mixed simultaneously**
- **Has 6 remote positions**
- **Complete cueing, monitoring and muting facilities**
- **Attractive 3 color finish**

Wartime restrictions do not allow the sale of new broadcasting equipment without priority, therefore, this equipment is presented merely to acquaint you with Gates' current developments.

Ask About Our Priority Plan for Prompt Delivery When Gates Equipment Is Again Available.

Gates RADIO COMPANY, Quincy, Illinois, U. S. A.

MANUFACTURERS OF RADIO BROADCAST TRANSMITTERS, SPEECH EQUIPMENT, ANTENNA TUNING AND PHASER UNITS, AMPLIFIERS, REMOTE EQUIPMENT, BROADCAST STATION AND TRANSMITTER ACCESSORIES

For Soldering in Tight Places . . .

DRAKE

No. 400 Soldering Iron

Smallest Industrial Iron Ever Designed

60 Watts—1/4 in. Tip

Only 9 in. long—Wt. only 8 oz.

This mighty mite is backed by DRAKE'S 25 years of soldering iron manufacturing experience. The high quality and long service of DRAKE Soldering Irons have made them outstanding favorites with all types of radio men everywhere. The DRAKE No. 400 is an outstanding value at

Only $4.50 List

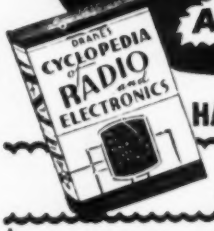
Drake Has an Iron for Every Purpose. Ask Your Radio Parts Jobber.

DRAKE ELECTRIC WORKS, INC.

3656 LINCOLN AVE., CHICAGO 13, ILL.

RADIOMEN—

1700 ANSWERS



TO YOUR HARDEST PROBLEMS

1178 Illustrations
1000 Pages
130 Tables — 105 Graphs

GET THE ANSWERS NOW!

Here, in one big volume, you'll find all the time saving answers to your radio problems . . . and time saved is **MONEY EARNED.** Written in easily understood language, yet accurate enough for an engineer. Completely revised and cross indexed for quick reference, this handy reference book for your tough jobs covers radio transmission and reception, public address systems, television, photocells and data on their important parts. It's a book you'll **always** use. And . . . it's only..... **$5.00**

ANOTHER TIME SAVING BOOK!

ELECTRICAL AND RADIO DICTIONARY. Over 3800 definitions of technical words and terms used in all branches of radio and electricity. 300 Pages—550 Illustrations..... **$2.50**

GATEWAY PUBLISHING COMPANY
53 W. Jackson—Dept. N3-A
Chicago 4, Illinois

Clip This Coupon NOW

☐ Send me the new Drake Cyclopedia IMMEDIATELY.
☐ And the 300 Page Radio Dictionary.

Name .....

Address .....

City..... State.....

big fuss over nothing. Of course some do have legitimate worrys, those who are so 'independent' with their curbstoners. Sure, we will have 'curbstone' repairmen and 'screwdriver' mechanics, but why not take in some of these boys who come back from service and help them to get the needed experience on civilian radios. They will make you money and at the same time it will help him in his chosen profession. Of course, if the 'screwdriver' mechanics get too bad, you can always get a state license passed, which would be a darned good idea (ask the man who had a good set ruined). I hope some of the guys who are hollering 'Wolf' so loudly will stick to their oar and state just why they are so afraid of the returning embryo radio servicemen."

D. V. TOLLE, W9EBT,
The Radio Shop,
Canton, Illinois.

"TONIGHT, reading the January, 1945 issue of RADIO NEWS, I found some letters from servicemen in the Army. I agree with PFC Miles V. Wolhowe of California, regarding the article on Mr. Becker's complaint.

"I want Mr. Becker to know that the Army schools have very good instructors and the experience we soldiers get in these schools is far ahead of that gotten in civilian radio schools.

"Although I have been working in radio for over nine years, I went through one of the Army schools last year and this short course gave me a lot more experience.

"I have repaired v.h.f. sets that Mr. Becker wouldn't be able to fix in six months. After the war is over, I want Mr. Becker to check on the ex-servicemen and see whether or not they turn into experienced radio men.

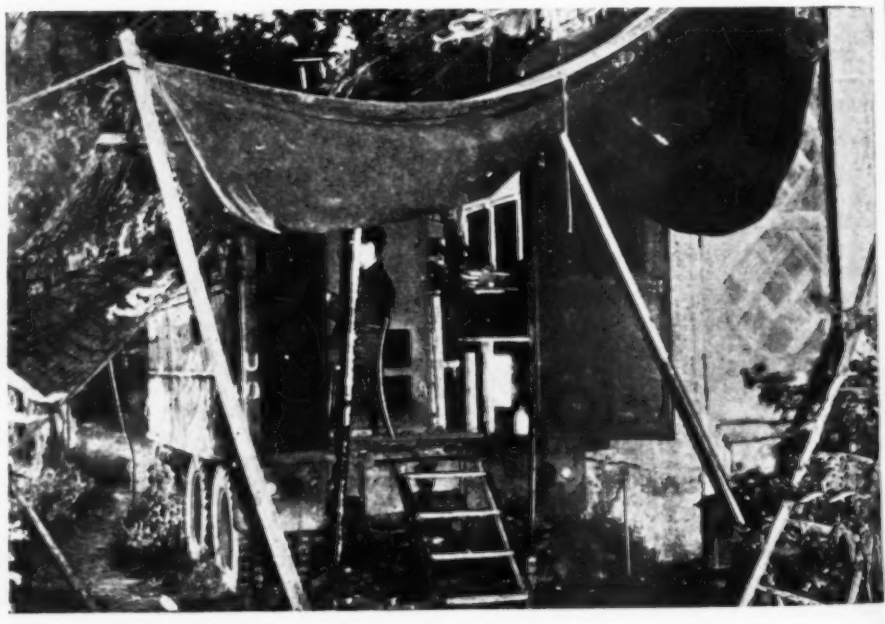
"I had my own radio shop before being drafted and I intend to have a better one, to keep up to date on the radio business, and go forward on research work."

PVT. FELIX RODRIGUEZ,
Camp Howze, Texas.

It is not the intention of the Editor to take sides on this question, but rather to play the part of the "interested bystander" of this column. However, we sincerely believe that this discussion "is shedding more heat than light" on the problem. No one can deny that the Armed Forces have done a magnificent job of training thousands of men to service their equipment quickly and accurately, nor can anyone deny that this work is of a highly-specialized nature. The average radio repairman may see more different types of equipment in one week than the man in the repair depot will see in a year, but this does not mean that the uniformed technician is any more or less well trained than his brother in mufti. There are a sufficiently great number of problems of readjustment which will have to be faced after the war without radio servicemen fighting among themselves or calling names. Let us stop making blanket statements regarding all men in the Armed Forces, or all radio servicemen at home, and let each group stand or fall on its own ability when the postwar opportunities arise.

—30—

Station PX of Press Wireless, Inc., was the first civilian radio station to link America and France with direct dispatches from Normandy. Photograph shows the motor-truck-contained station, camouflaged and on location somewhere in France, not long after it landed. Dispatches averaging more than 30,000 words daily have been received from the station which is operating with a 400-watt transmitter at speeds of more than 250 w.p.m. Messages are picked up at the receiving station at Baldwin, L. I., shot to the Times Square control headquarters and there distributed to the press. The first news dispatch sent over this station was filed at 5:50 A.M., EWT, June 13, by the United Press. Station PX is at the service of all war correspondents in the battle area and is also authorized to handle government and commercial traffic.



STEATITE AND STEEL PERMANENTLY BONDED TOGETHER

● SEALEX Bushings developed by General Ceramics and Steatite Corporation are the answer to the problem of hermetically sealing all types of communication equipment.

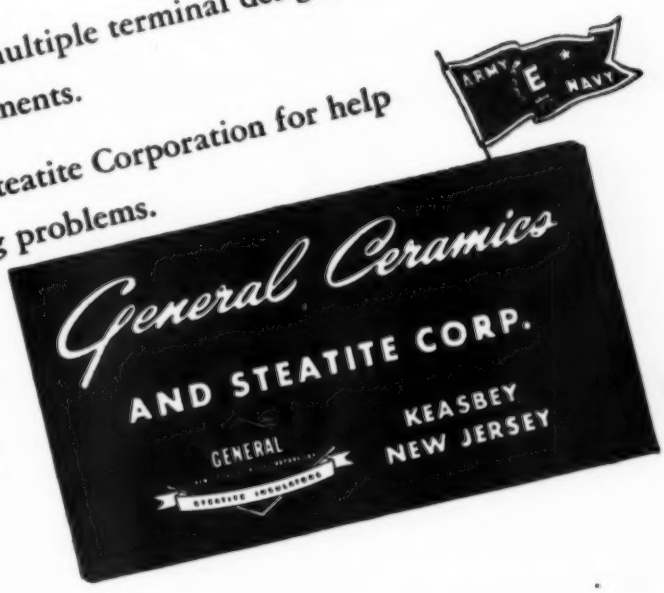
SEALEX Bushings will contain air at 50 pounds per square inch after a thermal change test of 25 cycles from −65 C to +125°C.

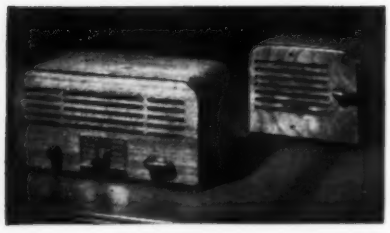
Available in single terminal and multiple terminal designs for high and low voltage requirements.

Contact General Ceramics and Steatite Corporation for help in solving your hermetic sealing problems.

SALES REPRESENTATIVES

H. W. GEBHARD
737 No. Michigan Ave., Chicago, Illinois
J. J. PERLMUTH & ASSOCIATES
942 Maple Avenue, Los Angeles, Calif.
MICA COMPANY OF CANADA LTD.
P. O. Box 189, Hull, Quebec





Ask YOUR JOBBER NOW!

About the world's most complete line of Inter-communication. . . .

Talk-A-Phone

A highly perfected product of years of specialization and a far step in advance, Talk-A-Phone sets the pace for progress. It "*Has Everything*" . . . styling, convenience, efficiency, flexibility. A unit for your every requirement. Easy to sell. Certain to render continuously satisfactory service. Good deliveries now. Ask your jobber. Don't be satisfied with *less* than "Everything."

TALK-A-PHONE MFG. COMPANY
1512 S. Pulaski Road Chicago 23, Ill.

OLSON Radio Warehouse

REPAIR KIT

FOR RADIO CABINETS

$2 POSTPAID

Handy box with 9 shades of shellac sticks, light and dark stains, metal shading varnish, polish, Scratch Stick, alcohol lamp, alcohol, spatula, brushes, steel wool, sandpaper, felt, rubbing fluid, wiping cloth—everything you need to repair wood, plastic or bakelite cabinets, knobs, etc. A value!

MAIL TODAY

OLSON RADIO WAREHOUSE
73-A Mill St., Akron, Ohio

Please send me . . . . Repair Kits at $2.00 each. I enclose ☐ check ☐ money order.

NAME.....

ADDRESS.....

Emergency Receiver Tests

(*Continued from page 37*)

With the tube removed from its socket, the headset-and-battery test equipment as rigged for continuity testing may be applied across the filament or heater pins—usually pins No. 2 and No. 7—to check the continuity. A tube-base diagram will be helpful. Except in the few cases of some special tubes, continuity between any other elements indicates some internal short circuit and the tube had best be discarded for a new one.

The High-Voltage System

In testing the high-voltage system, the voltages from the radio receiver are substituted for the battery previously used and a capacitor of from 0.1 to 1.0 μfd. is substituted for the headset as an indicator. With tubes in place and the receiver turned on, charge the test capacitor by means of actual or improvised test prods across the high-voltage input to the receiver and ground. Next quickly remove the prods and short their tips together. A spark indicates that the capacitor has become charged and that high voltage was present across it. Working from the source of the high voltage, the test capacitor should be similarly charged and discharged across ground and the plate and screen-grid socket connections at each tube. This will indicate whether or not the high voltage is reaching the tube elements.

A headset may be used in the testing circuit, retaining the capacitor in the circuit to protect the headset from the high-voltage direct current. A click will be heard in the headset as the capacitor charges up from the high-voltage source. When shorting the test prods after each application across high voltage, a second click will be heard in the headset as the discharging current flows through the earphones. Be extremely careful in using these testing methods across high-power audio stages such as those encountered in larger types of receivers or public-address amplifiers. There is no particular danger with standard transformerless a.c.-d.c. radio receivers.

Testing Audio Output

With the receiver turned on and with the headset, blocking capacitor, and test prods still connected in series, ground one prod and touch the plate connection of the output tube. If the receiver is operating properly in front of the output tube, receiver noise (or the station to which the receiver is tuned) will be heard in the headset. If no indication is heard, repeat the test at the plate of the previous audio tube. If the signal is still not obtained, the trouble is probably not with the audio system but in the r.f. or i.f. portions of the circuit.

Signal Tracing

For use as an emergency signal generator, a small battery—such as the same 4½-volt "C" battery used previously in testing continuity—is used. The test prods are connected to it through a resistor of approximately 100,000 ohms in series with one lead. With the receiver turned on, touch the free ends of the prods across ground and the grids of the successive tubes working back toward the antenna from the final output stage. A disturbance in the speaker indicates that all stages between the test prod and the speaker are operating. The stage at which the disturbance in the speaker caused by the application of voltage to the grid disappears is presumably the stage in which there is a faulty component which can then be isolated easily by continuity testing.

-30-

U.H.F. Course

(*Continued from page 62*)

tric fields, he called displacement currents. Both, he said, gave rise to magnetic fields.

A classical example to illustrate the above is given with a fixed condenser in a setup such as shown in Fig. 6. Closing the battery switch will cause current to start flowing in the circuit. Since electrons do not flow across the space between the plates, it might be said that the circuit is open at this point. However, since the number of electric lines of force between the plates are changing, due to the charging effect of the condenser, then, according to Maxwell, the circuit is now no longer open at this point. Instead of electrons or conduction currents flowing across this space, we now have a displacement current and the circuit is continuous. It would even be possible to detect a magnetic field produced between the condenser plates during that portion of the time when the condenser is charging up and the electric field is varying in this region. The entire process ceases, of course, when the condenser becomes charged.

The above was all that was needed to allow Maxwell to set up his basic equations. From these he developed the idea that electromagnetic waves travel through space at a finite or measurable velocity which we know to be approximately 186,000 m.p.s.

Electric and Magnetic Fields

If the reader is a bit puzzled as to why Maxwell needed this added idea of changing electric fields giving rise to magnetic fields, let him pause for a minute and stop to consider that in the space between the transmitting antenna and the receiving antenna there is no flow of electrons at all.

CHECKING RELAY REBOUNCE BY MEANS OF DuMONT *Oscillography*

Parasitic oscillations caused by rebouncing relay contacts can prove mighty troublesome. However, *DuMont Oscillography* (oscillographic equipment plus the know-how) can be invaluable in determining the source of such difficulty as well as providing conclusive evidence that remedial measures have proved effective. For instance:

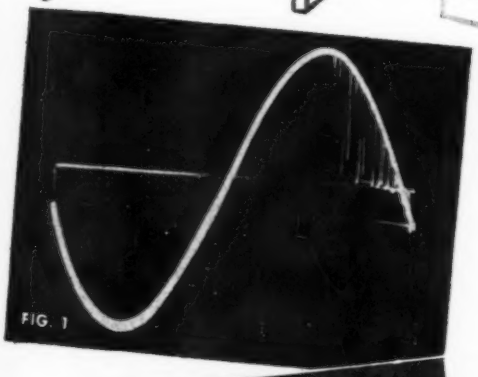


FIG. 1

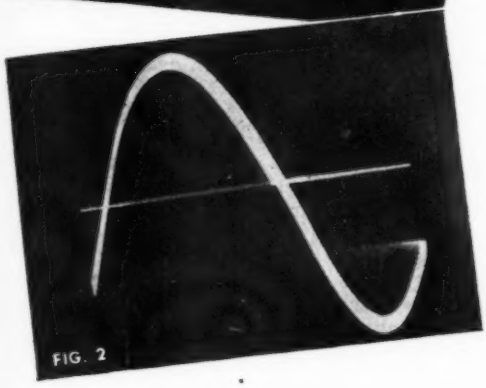


FIG. 2

A standard DuMont oscillograph with single-sweep feature is used. No additional accessories required. Relay is actuated by closing a switch. Relay contact applies 60-cycle wave to vertical deflection plates of cathode-ray tube. With sweep frequency set at 60 cycles, one complete sine wave period appears on screen.

If relay contact closes without rebounce, the transition from horizontal line to sine wave is a simple straight line and generally occurs so quickly that it is difficult to observe visually. However, if rebounce is present, the interruptions are indicated by a series of parallel vertical lines readily observed, as in Fig. 1.

If it is desired to determine the number of interruptions and duration of rebounce periods, photographic records are made. Since the frequency of the sine wave is known, the evaluation of results is simple. In this oscillogram there were over 20 rebounces before establishing definite contact. Total duration of series of rebounces is 1/250th second. Time between opening and closing of contact is about 50 microseconds. Greater accuracy may be had by using higher frequency wave generated by an external oscillator.

Fig. 2 oscillogram demonstrates that rebounce has been eliminated by cadmium plating the contacts, amalgamating with mercury, and finally dropping liquid mercury on them.

An illustration from hundreds of useful applications of DuMont Cathode-Ray Oscillographs. Perhaps your measurement technique can be simplified or improved upon by DuMont.

© ALLEN B. DUMONT LABORATORIES, INC.

DUMONT *Precision Electronics & Television*

ALLEN B. DuMONT LABORATORIES, INC., PASSAIC, NEW JERSEY · CABLE ADDRESS: WESPEXLIN, NEW YORK

NATION-WIDE MAIL ORDER DISTRIBUTORS SINCE 1928

BA

RADIO AND ELECTRONIC DEVICES For...

TRADE
INDUSTRY
VOCATIONAL
COMMUNICATION
PUBLIC UTILITY
and
EXPERIMENTAL
APPLICATIONS

BURSTEIN-APPLEBEE CO.
1012-14 McGEE ST.
KANSAS CITY 6, MISSOURI

CORWICO

WIRES

MADE BY Engineers FOR Engineers

concentrating upon VICTORY
for the duration.....

cornish
WIRE COMPANY, INC.
15 Park Row, New York City, New York

CORWICO

How then could we have an alternating electric and magnetic force at our receiving antenna (and we do) when the transmitter may be thousands of miles away? Electric currents may have set these waves up originally at the transmitting antenna, but once this is left behind we find that it is of little interest. It would be impossible to explain this wave travel on the old idea of electric currents being necessary for the generation of magnetic fields. But with the idea of changing electric fields also having this property, this matter is quite simply explained, as will be presently shown. And when these fields, in their travel through space, come across a conductor like our antenna wire, then alternating currents are again set up. The energy comes from the traveling fields.

Energy in Electromagnetic Waves

Since a field can be propagated through space, it must of necessity have a certain amount of energy. Where does this energy come from? There can be only one answer to this question: from the currents producing the field. When the current first started flowing, a certain amount of energy was put into the electromagnetic field surrounding the conduction. If at any time the current should cease to flow, then the magnetic field would collapse and return the energy back to the conductor. In the case of an antenna, the energy put into the fields never gets back to this same system for the simple reason that the fields do not remain in the vicinity of the antenna but travel outward in all directions. The energy that is lost in this manner then represents power that is lost as far as the transmitter is concerned. Radio engineers say that this energy is lost in a radiation resistance which is a fictitious term but serves their purpose of representing the lost power in their equations. Broadcast stations would like to make this radiation resistance as large as possible since the power thus lost is picked up by the thousands of receiving antennas tuned to the same wavelength—their listeners.

Summary of Electric Field Behavior

Before continuing on to the magnetic theory it would be best to make careful note of what has been discussed so far about electric fields. It was found that an electric charge gives rise to an electric field and that this electric field exerted a force on other charges, or, what is the same thing, on other electric fields. It was also seen that a static charge had only an electric field connected with it while if this charge was put into motion a magnetic field would be produced as well. If the strength and the direction of the electric field were constant, the magnetic field produced would also be constant. If either the amount or the direction of the electric field, or both, varied then the magnetic field would likewise vary.

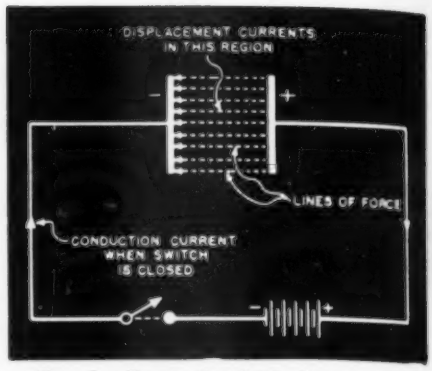


Fig. 6. A simple illustration to represent Maxwell's displacement currents.

This, then, represents what has been discussed to this point and as far as electric field theory is concerned, enough has been covered—at least for a while.

(To be continued in June issue)

World's Greatest Airline

(Continued from page 27)

AACS stations would be set up along the M-A-T routes to be operated by the Ferrying Division. It was also agreed that the identical air-ground radio equipment used in commercial planes, the Bendix transmitter-receiver, would be installed in all Ferrying Division transports as speedily as possible.

Work went forward immediately. In August, a new AACS ground-air radio station, known as the New Castle airways station, opened at the 2nd Ferrying Group at Wilmington, Delaware. Other stations, of course, had already been in operation, with older facilities altered to meet present needs.

Installation of the Bendix receiver-transmitters went forward apace. By midsummer, most of the planes flying under the M-A-T purple and brown Flying Hawk insignia were equipped with this invaluable aid to safe and efficient flying.

Work is still in progress, but should be completed early in the fall of this year, with all 47 AACS stations in full operation and every plane flown by M-A-T equipped with the new equipment.

With this system in operation, it is possible for an M-A-T plane in flight anywhere over the country, to communicate at any time directly with Ferrying Division Headquarters in Cincinnati. The pilot of the plane talks to the nearest AACS station, which in turn talks to the Headquarters of the Ferrying Group which is operating the M-A-T route. The Ferrying Groups, evenly spaced throughout the United States, are connected by land-line network with Headquarters of the Ferrying Division. Thus, the pilot can at any time avail himself not only of the latest weather reports, but of advice from the wisest heads in the business of flying.

After ADOLPH and TOJO are Q·R·T

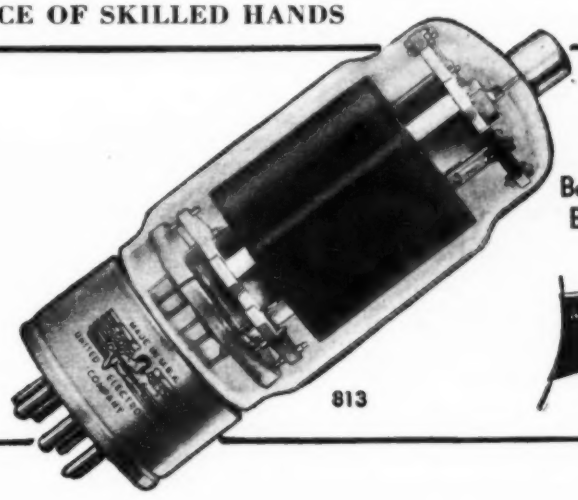
The rig he left behind is due for a big change when GI Joe comes home. War experience has been an "eye opener" for him. From chassis to sky wire many pre-war Ham outfits will undergo a major alteration and amazing technical advances will be put into practice. Stimulated by training and experience gained in the armed services thousands of new enthusiasts will swell the ranks of amateur radio.

When the gang goes back on the air again, CQ'ing, SS or DX; UNITED will be ready to serve the Amateur with war-perfected Transmitting Tubes.

Since 1934 UNITED has specialized in engineering, designing and building Transmitting Tubes that set the Quality Standard for the entire Radio Industry. When performance counts UNITED Tubes provide a maximum of electronic efficiency—plus a long and dependable life. Accept nothing less than UNITED quality for your own tube requirements.

Order direct or from your electronic parts jobber.

MASTERPIECE OF SKILLED HANDS



Back The Attack
Buy More War Bonds

UNITED

ELECTRONICS COMPANY

NEWARK, 2 NEW JERSEY

Transmitting Tubes EXCLUSIVELY Since 1934

IMMEDIATE DELIVERY

RADIO PARTS

AND SOUND EQUIPMENT

Hookup and pushback wire—assorted colors—89¢ per 100'—10 assorted 100' rolls $7.80
Assortment 50 terminal strips—two to 6 lugs..... 1.69
Assortment of 25 popular Dial faces for radios..... 2.95
Assortment 100 radio knobs—set screw and push on..... 6.95
5" P.M. Speakers..... 1.49
6" P.M. Speakers..... 2.25
8" P.M. Speakers..... 4.75
12" P.M. Speakers..... 7.75
5" 6 volt Auto Speakers..... 1.68
8" 6 volt Auto Speakers..... 1.59
6 x 9" Oval Auto Speakers..... 1.59
Single conductor microphone cable—short lengths—6 to 40' 8¢ per foot.

Send L265 certificate with order. Bulletin listing hundreds of items for radio and sound men sent with each order.

LIFETIME SOUND EQUIPMENT CO.
P.O.BOX 834 TOLEDO 1 OHIO, U.S.A.

FIX ANY RADIO
Amazing New Invention

Learn to repair radios in minutes instead of hours. Revolutionary, different **Comparison** technique permits you to do expert work almost immediately. Most repairs can be made without test equipment or with only volt-ohmmeter. Simple point-to-point, cross reference, circuit suggestions locate faults quickly and easily.

FOR BEGINNERS OR EXPERTS

Find any radio fault with ease. Follow the comparison tests given on 16 large trouble-shooting blueprints, 76 fact pages. Over 1,000 practical repair hints. Hundreds of simplified tests using a 5c resistor and a filter condenser. Covers every radio set—new and old. Introductory material for beginners and to serve as a review for experienced radio men. Also several chapters on test equipment. Presented in manual form, 8½ x 11 inches. Entire plan is stark new and will change servicing methods. Used in schools, Armed Forces, and by thousands of radiomen.

SATISFACTION GUARANTEED

Take advantage of our "no-risk" trial. Send coupon today. Use this time-saving, money-making radio servicing method for 10 days without any obligations. See how much time you will save every day on every radio job. Learn new short-cuts in radio servicing. Then decide to keep **Comparison Method Manual** or return it and receive a cash refund. You cannot lose—but you owe yourself a chance to look at this plan. Price, complete, only $1.50.

Developed by M. N. Beitman, radio engineer, teacher, author, & serviceman.

NEW 1945 EDITION

The training will more than pay for itself on the first radio job. Examine and use this unique plan for 10 days at our risk. Send coupon right now—use the plan this week.

TRIAL ORDER COUPON

SUPREME PUBLICATIONS, 9S. Kedzie Ave., Chicago 12, ILL.

Ship the new manual, **Simplified Radio Servicing by Comparison Method**, for examination. I am enclosing $1.50, full price, send postpaid. I must be satisfied or you will refund my money.

NAME:.....

ADDRESS:.....

Results of securing this system of 47 AACS radio stations for constant air-ground communications for M-A-T planes have been gratifying.

The three missions of M-A-T have been carried on with faultless precision.

Since April 19, 1944, evacuation transports have, as of Dec. 1, 1944, conveyed approximately 32,000 patients from coastal to inland hospitals without a single fatality. Altogether, M-A-T has safely flown approximately 25,000,000 patient miles.

Ton miles flown by M-A-T cargo ships have gone up from a relatively small figure in May to more than three-quarters of a million ton miles flown in July, with every assurance that the cargo planes would have flown more than 1,000,000 ton miles when the August figures were in, and that the total would continue to mount.

Figures on how many crew members have been carried by M-A-T cannot be revealed for reasons of military security, but the number is a large one, and it continues to increase month by month.

With an anticipated further increase in the number and length of routes flown by the Military Air Transport lines of the Ferrying Division, the value of the Ferrying Division's move in leading the way to modernized air-ground radio communications for its air transport lines becomes even more apparent not only to military men, but to the families and friends of wounded men who are flown on evacuation transports, and to the wives, sweethearts, families and friends of the gallant pilots and crews which man the sky ships of the Ferrying Divisions' Military Air Transport lines.

-30-

Portable Disc Recorder

(*Continued from page* 35)

nue of jobs. As the demand of organizations grow, there will be increased opportunity for manufacturers and sellers.

Something new in the sound field is a device which quickly picks for playback a definite spot in a recording. Designed by W. D. Fling of Fairchild, with an eye to foreign language records, this simply-operated language master is ideal for the replaying of an unusually difficult foreign phrase, or a recorded mistake by a student. Several colleges make a practice of recording the speech student's voice on entering, at the middle of the year, and at its close. Progress or lack of it is noted and student graded accordingly. Recordings made of expert speakers either directly or picked up from a radio broadcast are of great value as speech class models. Also of value is the public-address system features of sound equipment which may be used whenever the occasion arises to address a number of people outside the average voice range.

A library of outstanding recordings of numerous kinds of sound may contribute much to a large number of educational fields, including language, music, drama, science, and industrial training. Recorded history-making occasions, as a speech by Adolf Hitler, or the broadcast of Allied forces invading France add priceless material to libraries. Recordings are made of music by individuals and institutions and the folk songs of America are well perserved in these libraries by means of instantaneous recordings.

In industrial training classes, prospective salesmen can brush up on their techniques by listening to a recording of their own line of persuasion. Studying singers and actors check on their progress, or learn from an expert's recorded words. A singer who may wish to practice when his accompanist is busy may record the accompaniment and play it back whenever he needs it.

Physical education instructors who complain they use much of their energy and time shouting instructions, welcome instantaneous sound recording. Speaking his instructions into the microphone before his class arrives, the teacher plays them back later, saving his voice and using class time to watch carefully student performance.

Instantaneous sound recording has already gained a strong foothold professionally. Radio networks record all of their broadcasts for reference purposes and a good percentage of radio stations use the equipment for sound effects and for delayed recording. Transcriptions also are used to broadcast a program over stations too far away from the central broadcast to send it out clearly.

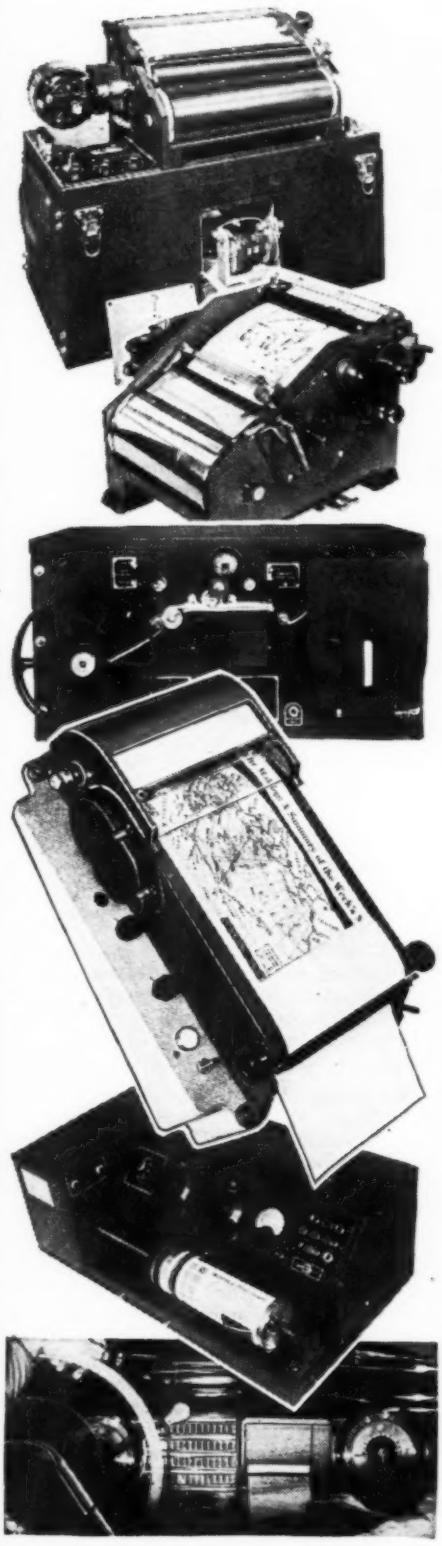
Sound-movie makers who use instantaneous sound recording for dubbing onto film find the equipment also valuable for rehearsal purposes. Scenes recorded and played back while the actors are still on the set may be perfected without wasting film, thus cutting down costly retakes.

Figuring prominently in this war, instantaneous sound recording has proven valuable in teaching Navy personnel the difference between the sound of submarine and "fish-talk," the name for underwater mouthings of the fish. Hard for a layman to distinguish, these are clarified in the Navy classroom by the playback of both noises. For this purpose the equipment is specially prepared for underwater operation.

Criminals planning prison breaks are frequently foiled by equipment hidden in their cells by officials. Recording through amplification their slightest whisper, the discs provide the law with closely guarded underworld secrets.

The quality of instantaneous recordings has been greatly improved since it was first developed in 1930. The first pressings in the United States were produced from recordings cut

ALDEN



for Graphic Recording of any kind

OUR YEARS OF EXPERIENCE, and cumulative skills, in the designing and production of RADIO COMPONENTS, are now being used in making equipment which covers ***the entire field of FACSIMILE.***

Actual service, as found in war and communication work under all conditions, has given a PRACTICAL quality to our equipment which, under ordinary conditions, would not have been obtained in years of engineering with limited application.

ALDEN PRODUCTS COMPANY is manufacturing practically ALL TYPES AND SIZES of facsimile and impulse recording equipment—using all the varied recording mediums: Photographic Paper, Film, Electrolytic Paper, Teledeltos, and Ink.

ALFAX IMPULSE RECORDING PAPER

•

By "COVERING THE ENTIRE FIELD," we mean . . .

1. Some of our equipment has been used for the transmitting and receiving of photographic pictures of reasonably high resolution (such as the war pictures now appearing in the news).

2. Continuous Recorders—of the type whose value has been proven on National and International news service circuits—are now on their way to the Orient, to be used for the receiving of the so-called "picture" languages. They use ALFAX paper.

3. Also, through the use of ALFAX (the first high-speed black and white permanent recording paper), HIGH-SPEED Signal Analysis Equipment has been made possible for various laboratories and Government Departments. Other equipments have employed Teledeltos Paper for message work and other purposes.

4. For outlying posts, where servicing equipment is an impossibility, or, where radio or wire links are of poor quality and power, ALDEN Tape Recorders (recording medium, ink)—have been designed to operate with a minimum of trouble and adjustments, and have PROVED MOST SATISFACTORY.

5. The ability of ALFAX Paper and ALDEN Machines to record impulses *as they occur*, without the inertia problems of many previous methods, has made possible other recorders at various speeds (including slow). They will record a whole day's history of related phenomena, with time indicated, and often—with self-calibrated linear reference marks for ready interpretation.

ALDEN PRODUCTS COMPANY

117 North Main Street

BROCKTON 64K, MASSACHUSETTS

110-VOLTS AC from DIRECT CURRENT

with KATO KONVERTERS. Furnish standard 110-volt AC from 32, 110, or 220-volts DC. Good deliveries on sizes 350 through 1500 watts.

PIONEERS IN THE BUILDING OF SMALL ROTARY CONVERTERS

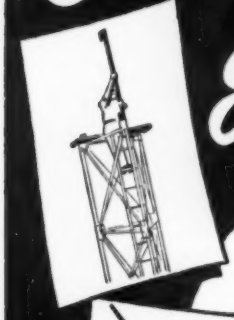
Katolight Rotary Konverter, 225 Watt

Good deliveries on 5, 7½, 15 and 25 KW AC generators. Mfgr.'s DC generators, motor generators, frequency changers, high frequency generators.

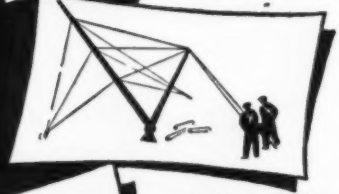
Kato's entire production at present must be confined to orders with priorities.

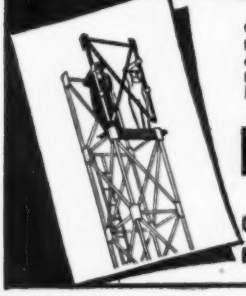
KATO ENGINEERING CO.
120 Rock Street Mankato, Minnesota

Easy to Erect



MASTS AND TOWERS





Catalog will be sent to engineers and executives writing on their business letter head.
Address Dept. AP

HARCO
STEEL CONSTRUCTION CO.
Elizabeth 4, N. J.

in wax, electroplated to make a stamper. This is the type sold over the counter at record shops today.

The blank instantaneous 12-inch acetate disc with aluminum or glass base costs about $1, with an approximate cost of $75 per master. Equipment for the wax-cutting method costs far more than for instantaneous, and moisture and temperature conditions must be carefully controlled. Instantaneous recordings can be made under much less favorable conditions with good results.

Of the two methods of producing records from an instantaneous recording, i.e., dubbing copies on two turntables, or making a stamper for pressings, the second is most practical for mass production. A U. S. government agency shipping hundreds of thousands of records overseas for the Army each month makes extensive use of pressings produced from acetate masters.

The new Fairchild portable recorder is mounted in a sturdy trunk, and meets the requirements of direct lateral recording and reproducing of sound on discs up to 16 inches in diameter, at two speeds: 33.3 and 78 revolutions per minute. Supplied with cables and connectors necessary for attachment to the amplifier-equalizer, it may be set up in five minutes either indoors or outdoors.

Where double turntable or continuous recording is required, a second identical unit can be connected to the amplifier-equalizer in receptacles provided in that instrument. Switching facilities are in the amplifier panel.

The turntable arrangement enables a record made in a certain number of minutes and seconds to be played back in that exact time. Because every second counts in a radio transcription broadcast, the turntable, driven at 33.3 r.p.m. direct from the center through worm and gear by an 1800 r.p.m. synchronous motor, is valuable to stations for its split-second accuracy.

By the positive center drive it is

TRIBUTE TO RADIOMEN

THE Veteran Wireless Operators Association paid tribute to the heroic radiomen and communications personnel of the Armed Forces and Maritime Services of the United Nations, at their twentieth anniversary dinner-cruise, at the Hotel Astor, Saturday, February 17, 1945.

The opening message to the Association was sent by General Dwight D. Eisenhower in the following radiogram to William J. McGonigle, President of the VWOA:

"Duly appreciative of your invitation to be a guest of honor at the 20th anniversary of the Veteran Wireless Operators Association.

I regret my inability to accept, but am glad to testify to the great debt all of us owe to the Signal men in this Theater of War. Signal communications are the indispensable servant of command. Without them, the effective control of a vast modern fighting force would be an impossibility. Signal personnel of this Theater have, from the very beginning of the Invasion, been characterized by a high order of skill, devotion to duty, and in the Forward Areas, an exemplary courage and fortitude.

I wish you every success in your 20th anniversary celebration."

Sincerely,
DWIGHT D. EISENHOWER

Another radiogram from Admiral King to the VWOA reads as follows:

"Rising above the necessary restrictions of secrecy, widespread public acclaim has attended the miracle of modern communications equipment and its contribution to success in this war. Perhaps too little has been said of the human element in war communications.

As the Veteran Wireless Operators Association has been mindful of the vital element of public service in the peacetime work of the wireless operator, it is appropriate to pay tribute to his devotion to duty and his great contribution in fighting the war.

It is my wish to emphasize his fighting participation so that full recognition may be accorded the similarity and identity of purpose which exist between the communicator at his radio key and the gunner at his firing key—a similarity which reaches its full synthesis in modern combat.

One of the first and most acute needs to make itself felt in the preparation for war was that for the rapid expansion of Naval Communications personnel. That need was first met in large measure by the prompt and patriotic response of the commercial operators, especially the 'oldtimers.' Then, as preparedness was pushed and the subsequent tempo of the war itself intensified the need, came the extensive program for training of new operators. Wartime training in the technical skills of wireless operation of necessity, had to be rapid and yet had to meet the higher standard of proficiency required of the communication fighter of today. His skill has had to match the complexity and efficiency of the instruments he has had to man."
ADMIRAL ERNEST J. KING

General MacArthur and Admiral Nimitz were also invited as guests of honor, sending similar messages to the VWOA.

The Marconi Memorial Award Plaque awarded by the Veteran Wireless Operators Association was given the Television Broadcasters Association in significance of things already done and because of the initiative shown to insure world pre-eminence for American Television.

The Marconi Memorial Medal of Service went to R. Morris Pierce of Italian Fleet and Luxemburg Radio fame.

The Marconi Memorial Medal of Achievement was given to Allen B. Du Mont.

Other Awards were made to outstanding heroes of all the Armed Services and the Maritime Service.

-30-

possible to dub in sound from a recorded disc at 33.3 r.p.m. to a synchronous driven movie film, with the a.c. line the only necessary interlocking device. The drive, through which power from the motor is applied to the turntable and feed screw at either speed, consists of a die-cast, dust-proof aluminum housing in which the gears, ball race and other moving parts are partially immersed in a lightweight oil.

The 33.3 r.p.m. speed is obtained by a 54 to 1 gear-and-worm reduction of the motor speed. This speed is translated into 78 r.p.m. by the ball race, a group of balls riding between two conical shaped races held together under spring pressure.

Strain on the gear is reduced and speed-changing mechanism protected from damage if shifted while the motor is running, by a simple but effective device; the turntable coasts to a full stop when the motor is shut off.

The turntable is a ribbed casting mounted on a steel flange secured to the turntable shaft. All parts are machined to close tolerances to prevent turntable wobble.

The recorder is equipped with a 110/120-volt, 60-cycle synchronous motor. The assembly is suspended below the recorder panel on a cradle which floats independently of its equipment to isolate motor vibration. A flexible coupling between the motor and drive frees recordings from vibration noises.

Anchored in castings secured to the recorder panel, the feed screw and two stainless steel guide rods provide a stable framework on which the cutterhead carriage travels. The feed screw carries no part of the weight of the carriage mechanism which is moved transversely across the turntable on the guide rods by a split nut which engages six threads of the feed screw. As high as 161 lines per inch at a good volume level for reference purposes may be recorded because of evenly-spaced grooves.

A simple method of changing the pitch and direction of cut is provided by a gear. A pitch of 98, 118, 141, and 161 lines per inch is selected merely by putting one of the four desired gears into place. The change of direction of cut is accomplished by the movement of a lever without the use of any tools. Necessity of removing feed screw is eliminated.

The Fairchild magnetic cutterhead, standard equipment for the portable recorder, is designed to record at unusually high volume level with little increase in distortion. At 98 lines per inch the cutterhead is capable of fully modulating the groove with minimum distortion. The moving armature is damped by exceptionally long cushion blocks and a positive way is provided to adjust it without disassembling the cutterhead, thus maintaining it in correct balance. The frequency response, as revealed by light measurement, shows an ideal curve for recording purposes up to 8,000 cycles. With a moderate amount of equalization, the normal efficiency can be extended further.

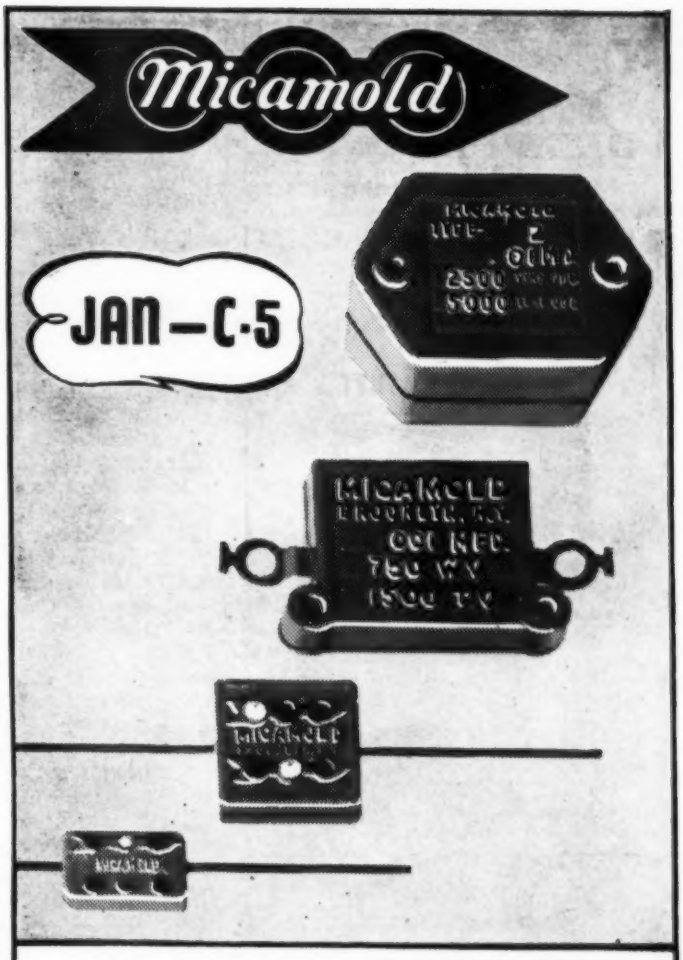
The cutterhead is mounted in an adapter which attaches to the mounting casting on the carriage assembly with one bolt. An important feature of the unit is the sapphire advance ball, with which the adapter is provided. The ball is on a swivel-type mount, adjustable instantly to change of direction of cut.

Maximum undistorted output is 12.51 watts from the 500-ohm winding of the T or H position on the output. The noise level below zero level of .006 watts at full gain of amplifier with bass and high controls turned off is minus 22 decibels, and the hum level is minus 40 db. The microphone input positions have a gain of 107 db. Both pickup positions have a gain of 61 db., and both line input positions a gain of 67 db. With dynamic pickups, the pickup inputs are wired for 50 ohm impedance at 107 db. gain.

With this amplifier-equalizer and two recorders, it is possible to record or play back continuously by switching from table to table; to make two identical records at the same time; to dub from one table to the other.

Fairchild and other manufacturers plan large scale development for the future. These instruments which entertain and instruct servicemen today will provide many of them with jobs and education when they return to the peacetime world of tomorrow.

—30—



FIXED MICA DIELECTRIC

CAPACITORS

JAN-C SPECIFICATIONS are called for on new Government contracts. MICAMOLD is supplying, in production quantities, the many required types in conformance with JAN C-5 specification.

— ALSO —

We can supply you with:

FIXED PAPER DIELECTRIC
(non-metallic cases)

FIXED PAPER DIELECTRIC
(hermetically sealed in metallic cases)

DRY ELECTROLYTIC POLARIZED

CERAMIC DIELECTRIC FIXED
(temperature compensating)

CONFORMING RIGIDLY TO JAN SPECIFICATIONS

MICAMOLD
Radio Corporation

115 Knickerbocker Ave., Brooklyn 6, N.Y.

ON HAND.. For IMMEDIATE DELIVERY . . . . .

CORD SETS

An excellent replacement for worn out cords. Will fit most all radios, lamps, fans, etc. Six foot, 2 conductor cord with rubber insulation over each conductor. Brown silk weave over all. Complete with bakelite plug. Special value. Each..... **22¢**

CONDENSER KITS

A very handy kit of 25 electrolytic tubular condensers, consisting of 3 each 8, 16, 20, 30, 40, dual 16 and dual 20, 2 dual 30 and 2—30x20 mfd. 150 working volts. Fresh, guaranteed stocks. Complete Kit Each..... **$5.85**

Send for Illustrated Flyer

R-L Electronic Corp.

731 W. Washington Bl.
Chicago 6, Ill.

The Symbol

of Time Tested QUALITY!

● Every Illinois Condenser bears the label of "TIME TESTED QUALITY" . . . manufacturing the best in capacitors is our business . . . satisfying you is our desire . . . look for the "Illinois" symbol of excellence when selecting paper and electrolytic capacitors.

ILLINOIS CONDENSER COMPANY
1160 NORTH HOWE STREET
CHICAGO 10, ILLINOIS

Spot News
(*Continued from page* 18)

placed radio high on the postwar popularity list. A rating of 85.6 was received by radio from dealers, 1853 dealers out of 2165 indicating that they will sell receivers in the postwar era.

A DETAILED STUDY OF ARMY COMMUNICATIONS was made recently by engineers and administrative personnel of the FCC during an inspection tour of communications bases in the South, Southwest, Pacific Coast, and Midwest. Among those who participated in the tour were Commissioners Norman S. Case, E. K. Jett, Paul A. Walker, and Ray C. Wakefield; FCC chairman Paul A. Porter; FCC chief engineer George P. Adair; RID chief George Sterling; FCC general counsel Charles R. Denny; and RID technical supervisor Charles A. Ellert. The FCC men were guests of Brig. Gen. H. M. McClelland of Army Communications. The tour was made in an Army plane, and will probably be followed by an inspection tour of Naval communications. This is the first time that the FCC had toured military installations as a group. Washington was quite pleased with this interest, believing that it will be extremely helpful in forthcoming civil-military activities.

THE FCC IS SCHEDULED TO RECEIVE an appropriation of $5,005,400, according to the House Committee on Appropriations. The Committee, reporting on the Independent Offices Appropriation Bill for 1946, said that this recommendation carries a reduction of $201,600 under the Budget estimate. However, an increase of $726,542 was allowed in the regular appropriation to take care of the increased activities that are expected from increased licensing and regulations. The budget for national defense activities was pared down quite a bit, the Committee reporting a net reduction of $1,225,914.

The increased grants for regular activities were based on testimony offered by FCC experts who declared that a substantial increase in FM, television, standard broadcast, facsimile, international broadcasting, experimental, and relay broadcasting applications is anticipated. Accordingly increased personnel and equipment will be required.

The fiscal year statement of the FCC, which covers a June-to-June period, disclosed how rapidly some of the increased grants and requests are pouring in. In 1944, there were 924 stations operating. This was an increase of 12 over 1943. In addition 16 new stations had been licensed during 1944, while 1689 applications for standard broadcast stations were received during the year. The statement also revealed that 202 applications for new FM stations had been received and 52 applied for television station permits. Since then the requests for FM and television station permits have increased considerably.

A lively year seems to be ahead for the FCC.

A RECORD INCOME was reported by the four major networks for 1944, income reaching the high figure of $126,330,491. This represents an increase of over 21% for 1943, and more than 100% increase since 1939. Over 700 affiliated network stations carried network programs during 1944. In 1943, only 661 stations were network affiliates.

This financial report also revealed that the Mutual Broadcasting System added 33 stations to its network, bringing their total of stations to 244. The Blue Network of the American Broadcasting Company added 20 stations for a total of 194. Nine stations were

NEW CODE-COPYING RECORD

A Central Signal Corps School instructor recently attained a code-copying speed faster than the world's record, and threw out his challenge to the champion.

After other soldier-instructors timed his transcription of a message at 79.4 words a minute during a 10-minute period, Cpl. James Ralph Graham, former Charlotte, N. C. telegrapher, expressed a desire to contest officially the record of Theodore R. McElroy, Boston manufacturer of radio equipment, who has held the world's record since 1921.

McElroy's code-copying record, attained at the recent tournament at Asheville, N. C., is 78.6 words a minute.

Graham, veteran telegrapher and teletype operator, is a comparative newcomer to the field of radio code in which International Morse code is used.

If he is forced to copy code faster than 79 words a minute in some future official contest with McElroy, Graham won't have to bother about typing speed. He has typed at the rate of 100 words a minute and his 79.4 transcription was accomplished on a G.I. typewriter. —30—

Cpl. Graham, who broke world's record.

added to the CBS roster, bringing that total to 143. And NBC added seven stations, providing a total of 149 stations from coast to coast.

THAT THE BBC WAS A PRIVATELY OPERATED system at its inception was disclosed at a recent industry luncheon in London. When the British authorities felt that broadcasting had been placed on a sound footing and had public acceptance, they then stepped in and placed the BBC on a government status. With government backing the BBC began to expand and provide a systematic schedule of programs that brought about large listening audiences. Speakers at the luncheon declared that several radio manufacturers had contributed to the fund to operate the original broadcasting system so that a program service could be initiated in London.

Discussing postwar receivers, speakers said that the first British sets will be similar to those of 1939 when the war first began, but that new designs would be provided as soon as economically possible.

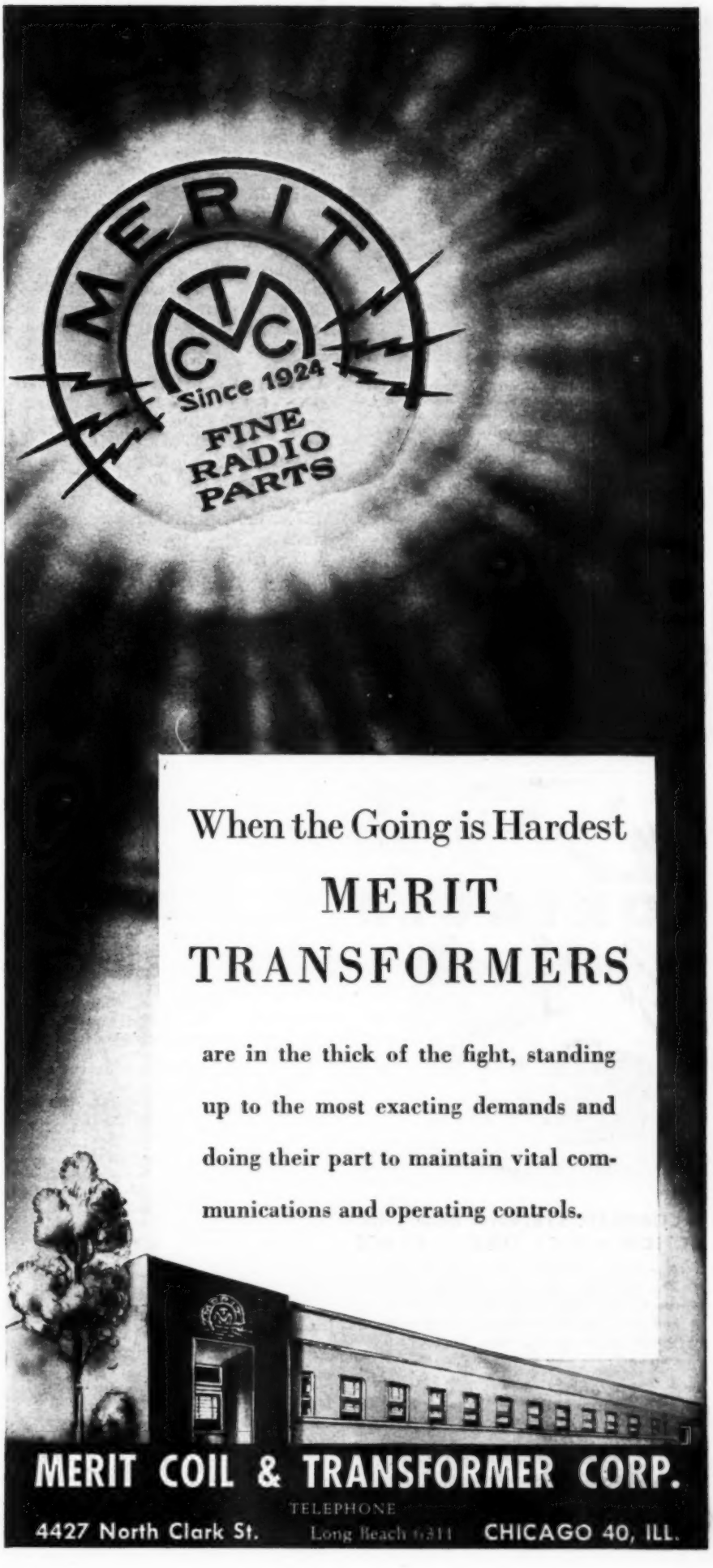
PHONOGRAPH RECORD SALES HIT A NEW HIGH in 1944. Over $2,000,000 in sales were recorded during that year. This is nearly 25% more than 1943 and 15% more than 1942. January appeared to be the best month with over a quarter of a million dollars in sales reported. In 1943, April was the best sales month, with sales slightly under the quarter of a million dollar rate, while in 1942, December seemed to be the best month, with sales also running close to the quarter of a million dollar scale. Predictions for the year indicate that record sales will streak ahead and bring the totals close to $3,000,000.

SOUND SYSTEMS ARE PLAYING quite an important role in gun locating. The War Department reports that accurate sound ranging has been used to locate the position of an enemy gun by picking up sound waves produced by the muzzle blast of the gun. That is, microphones pick up signals, which can be either enemy gunfire or our shell bursts, and transmit these signals to a central station, where they are photographically recorded by an oscillograph. From the differences of the times of arrival of the signal at the various microphone sites, positions are determined.

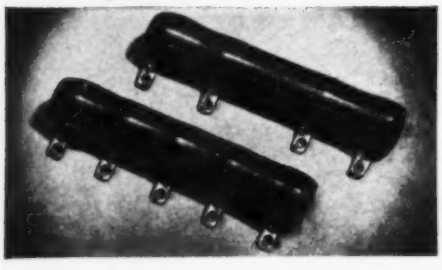
A distance of from 10,000 to 15,000 yards is covered by a microphone array. To connect the microphones to the recording stations, lines that run as long as ten miles are used.

TELEVISION

TELEVISION'S FUTURE ON LOW AND HIGH frequencies was spotlighted in a talk by former FCC chairman James L. Fly before the Television Press Club of New York recently. He said that we have an improved system of television in the six-megacycle band today. Larger screens are avail-


MERIT
CTC
Since 1924
FINE RADIO PARTS
When the Going is Hardest
MERIT TRANSFORMERS
are in the thick of the fight, standing up to the most exacting demands and doing their part to maintain vital communications and operating controls.
MERIT COIL & TRANSFORMER CORP.
4427 North Clark St.
TELEPHONE Long Beach 6311
CHICAGO 40, ILL.

SPECIAL RESISTORS
by Lectrohm



Developing new and special resistors to exacting specifications and for unusual applications is a full time specialty of Lectrohm engineers. These units have the same quality silver soldered connections, by Lectrohm's own method, as the broadline of standard Lectrohm resistors, which includes fixed types, adjustable, ferrule terminal and "Rib-on-edge" Resistors, and Power Line and R.F. Plate Chokes. Standard tolerances of resistance are held to ±10%. Durable vitreous enamel coating embeds accurately spaced windings, connections and core making an integral unit capable of maximum performance. Send your specifications for recommendations and prices.

LECTROHM
INCORPORATED

5131 West 25th Street, Cicero 50, Illinois
Division of
THE NATIONAL LOCK WASHER CO., NEWARK, N. J.

PORTABLE Sound

A COMPLETE SYSTEM • READY for ACTION • ANY TIME or PLACE

A powerful, compact unit . . . weighs only 39½ pounds . . . including amplifier, loudspeaker, microphone, power supply. Army and Navy users find it useful on land up to ½ mile, at sea up to 2 miles. Write for our catalog.

THE SOUND OF QUALITY

Newcomb
AUDIO PRODUCTS CO.
DEPT. M, 2815 SOUTH HILL STREET
LOS ANGELES 7, CALIFORNIA

able to provide excellent video reception, he declared, and there is no reason why this service should not move forward as soon as materials and manpower are available. Commenting on the higher frequencies, he said that above 400 megacycles tremendous opportunities exist. At those frequencies, we will have the broader band and the room for full color television, he predicted. He also pointed out that we soon would have the tubes required for successful high-frequency operation.

"And in the course of a very few years," he said, "we will move up to the higher frequencies and television will stay there with a splendid and enduring service."

A UNIQUE METHOD OF DEMONSTRATIONS FOR television was proposed by Ralph B. Austrian, executive vice president of RKO Television, at the press club luncheon. His method provides for the manufacturer of receivers to prepare television films and submit them to the local television stations.

Describing the costs of such films, he said that a good series of comedies or variety type of shorts may cost manufacturers about $7500 apiece.

(*Continued on page* 159)

Servicemen's Guide

(*Continued from page* 40)

your WPB field office. A list of these offices, along with their addresses, appears on page 41.

One note of caution; because of the constantly changing factors of supply and demand, currently effective regulations are often necessarily amended on short notice. Therefore, even though the information given in this article is up to date and in effect as of the time we go to press, later changes may have occurred which may make it necessary for your supplier to ask for other or additional priority assistance needed for filling your order.

Note to War Veterans: Radiomen returning to civilian life who have been discharged from the Armed Services may obtain release from the L-265 Limiting Order in the following manner:

Those men who were in the Radio Service business and have depleted their stock of radio tubes and component parts because of entering into the Armed Services, may obtain permission to purchase a new stock by submitting a letter to the Radio and Radar Division of the War Production Board, Washington, D. C., furnishing the following information:

1. Quantity and type of radio component parts which are required to establish them in business that was being done previous to their military duty.
2. Supply the name of the distributor with whom the order will be placed.
3. Include proof of discharge—photostatic copies if possible. These will be returned by WPB after verification.

The War Production Board will be glad to do anything they can to help these men in returning to their normal civilian activities.

(ED.: The author welcomes all correspondence in regard to this article. Readers who desire additional information, clarification, or have any questions, whatsoever, with reference to priority purchasing, should address their correspondence directly to Eugene Carrington, care of Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Illinois.)

—30—

Short-Wave

(*Continued from page* 100)

KKH, 7.52, Kahuku, Hawaii, has been heard relaying Chungking to CBS, 8:05 a.m. CHA, 15.220, Sackville, New Brunswick, heard 6:45-9:15 a.m., European beam, signs off in English and French, plays, "O, Canada." VUD-5, 7.30, Delhi, India, in parallel with 7.275, 9:15 a.m., music and Asiatic langues. (Duggan, Georgia.)

DZE, 12.130, Berlin, heard at 12:10 p.m. in German; good signal. "Radio Atlantik" heard on 9.760 at 8 p.m. with good signal strength; all in German. SUV, 10.050, Cairo, Egypt, heard at 3 p.m., working with Paris and New York, played recordings; good signal. A station on 12.120 (frequency of "Radio France," Algiers), was heard recently announcing as "Radio Paris," in English, working on hookup with Cairo and New York. JZI, 9.535, Tokyo, heard at 10 a.m. with news in English; little fading, signal fair to good. (Barry, New Jersey.)

ZFY, British Guiana, 6.000, has fine signal early evenings. Radio Tokyo on 15.225 and 11.897 heard nightly. Switzerland on 7.38 remains strong from opening of nightly transmission to North America at 9:30 to sign-off at 11 p.m.; the 6.345 beam fades around 10:15 p.m. PRL-8, 11.72, asks for reports, address, National Radio Station, Rio de Janeiro, Brazil; uses 50 kw., RCA transmitter. HH25, 5.94, Port-au-Prince, Haiti, heard well, 8-9 p.m. TGWA, 15.170, Guatemala City, heard well afternoons. Armed Forces Radio Station, 2.39 mcs. and 790 kcs., Canal Zone, heard 6:30 a.m.-12 m. ZNS-2, Nassau, Bahamas, 6.090, heard well evenings. HH3W, 10.105, Haiti, has a fine signal during the early evening. (Kentzel, N. Y.)

VUD-5, 7.275, Delhi, India, heard 9:45-10 p.m. with news in English for India and Burma; sometimes later in French. Announces next English newscast for 1:30 Indian time. Paris heard, 6-7 p.m. in French on 9.620. Berlin heard now evenings on 7.27. (Sussman, Mass.)

JVW3, 11.725, Tokyo, beamed to U. S., 8 a.m.-3 p.m.; not so good during the forenoon; closes down at 3 p.m. with Japanese national anthem; news in English at noon. Moscow on 15.11 heard irregularly from 6:20 to 6:45 p.m. Berlin on 10.543 is beamed to the U. S., 5:55-7 p.m.; at 7 p.m. begins Spanish transmission to Latin America.

THA3, "United Nations Radio," Algiers, heard a recent Sunday at 10:30 a.m. (Kernan, Mass.)

"Soldaten Sender West," heard on 7.025 in German. "Radio Atlantik" heard on 7.075 at 8 p.m. Moscow on 15.23 is heard 6:48-7:25 p.m., signs off with "Death to the German Invader." ICD, 13.220, press relay station in Italy, heard irregularly. ABSIE is good on 7.065. DZD, 10.543, Berlin, has been coming in like a local lately, early evenings. (DeArras, Virginia.)

I am still hearing "Radio France," Algiers, afternoon on 12.12. (De Hond, N. Y.)

AFHQ, 17.795, Italy, heard with press reports for New York's AP and UP, and Reuters, London. Say they're on every morning around 10:05 a.m. (Richards, N. Y.)

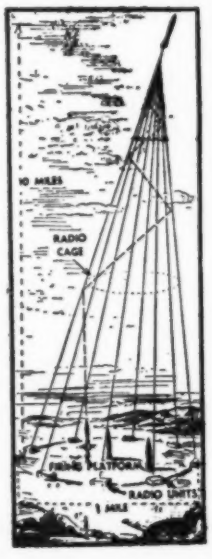
* * *

LAST MINUTE TIPS

PJC1, 5.945, Willemstad, Curacao, heard signing off at 10:31 p.m. HI2G, Ciudad Trujillo, Dominican Republic, on 9.220, heard with music at 11 p.m. HRN, Tegucigalpa, Honduras, on 5.875, heard signing off at 12:02 a.m. Radio Center, Moscow, heard a recent Sunday on 12.265 with news in English at 11:05 a.m. A new frequency for "Radio Atlantik" is 7.070, heard around 5 p.m. A station heard on Thursday at 4:30 p.m., with sign-off at 4:35 p.m., is thought to be Funchal, Madeira, a Portuguese island off the coast of Morocco. PJY, 9.340, Willemstad, Curacao, heard at 4:15 p.m. calling WGS. CNR, 9.082, Rabat, French Morocco, heard with music, 4:15-4:30 p.m. FXE, 8.020, Beirut, Syria, heard at 4:45-5 p.m. Dakar, French West Africa, on

---

HOW V-2 IS CONTROLLED



HIGH-ALTITUDE photographs taken by U. S. bombers record that V-2 rockets rise into the air in zig-zags controlled by a device known as a "radio cage," is reported from British sources.

This control equipment is carried inside the V-2 and is part of the system for altering the path of the rocket in flight.

It consists of a circular launching area ringed with radio units each sending up an invisible beam. These beams cone like a group of searchlights at a point perhaps 10 to 15 miles above the earth forming a cage enclosing the launching area below.

On striking any part of the cage, the projectile rising off the ground receives impulses from a beam which deflects it in a zig-zag path from one side of the cage to the other until it emerges at the top.

This aiming system establishes direction only; range is determined by fuel consumption.

-30-

MIRACLE of
Design!
"World's Smallest Transformer"
If you have a space or weight saving problem you'll want to know all about this remarkable new midget transformer—how it was developed by Permoflux engineers with new materials and manufacturing methods—how it was made small enough to be incorporated directly into the cases of earphones and hand-held microphones.
You'll be interested too, in knowing about its many application possibilities and about its outstanding operating efficiency and uniform response characteristics. This transformer can be produced to meet your own special design requirements.
Permoflux welcomes inquiry from design engineers about this new midget transformer. Write for our complete technical catalog listing Permoflux transformers, speakers, headphones and other acoustical devices.
BUY WAR BONDS FOR VICTORY!
TRADE MARK
PERMOFLUX
PERMOFLUX CORPORATION
4900 WEST GRAND AVE., CHICAGO 39, ILL.
PIONEER MANUFACTURERS OF PERMANENT MAGNET DYNAMIC TRANSDUCERS

ELECTRICIANS! RADIO MEN!

Earn More Money!

Get this new GIANT SIZE

ELECTRICAL and RADIO TROUBLE SHOOTING MANUAL

GUARANTEED BY COYNE

Yours 10 Days Free

OVER 500 Large Size Electrical and Radio Shop Prints -How to read and use them

Needed by war workers, maintenance men, beginners, old timers! Nothing else like it. Save time, helps boost your pay . . . 4 GREAT BOOKS IN ONE! 1. New Step-by-Step Trouble Shooting Course. 2. 500 Shop Prints. 3. Elec.-Radio Dictionary. 4. Spare Time Jobs.

FREE! 1 yr. Technical Counsel by mail from COYNE staff, on trouble-shooting problems.

SEND NO MONEY! See offer below. Satisfaction guaranteed by famous COYNE "Learn-by-Doing" Electrical School. Rush coupon now!

H. C. LEWIS, Pres., Dept. 4S-T3
COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Chicago 12, Ill.

FREE TRIAL COUPON

Send, with all shipping charges paid, your new COYNE Electrical and Radio Trouble Shooting Manual. Within 10 days after getting it I'll either return it or send $3, then $3 monthly until total of $8.90 is paid. [ ] Cash price $8.00—you save over 10%. Same 10-day free trial and return privilege.

NAME_____

ADDRESS_____

CITY_____ STATE_____

MASTER THE CODE with MASTER TELEPLEX

All A. C. operated. The only all-in-one instrument that will record your own sending and repeat it back.

Records signals from the air and repeats back at any speed.

The perfect instructor for both sending and receiving.

A postcard will bring full details and how you may secure MASTER TELEPLEX for ten day free trial. Ask for Booklet Q 12.

TELEPLEX CO. 107 Hudson St. Jersey City 2, N. J.

LES — Correspondence Courses in RADIO and ELECTRICAL ENGINEERING

ELECTRICAL ENGINEERING Get good grasp of wide electrical field. Prepare yourself at Low Cost, for secure future. Modern course. So simplified anyone can understand quickly.

RADIO ENGINEERING Extra fine course in radio, public address, photo-electric work. Trains you to be super-service man, real vacuum-tube technician. Servicemen needed badly. Diploma on completion.

WRITE Send postcard or letter for Free Copies of school catalogs, full details, all about deferred payment plan, etc. SEND NOW! **LOW AS $25 Either Course**

LINCOLN ENGINEERING SCHOOL, Box 93HR-76, Lincoln 2, Nebr.

PEN-OSCIL-LITE

Extremely convenient test oscillator for all radio servicing; alignment • Small as a pen • Self powered • Range from 700 cycles audio to over 600 megacycles u.h.f. • Output from zero to 125 v. • In use by Signal Corps.

GENERAL TEST EQUIPMENT CO.

38 Argyle Buffalo 9, N. Y.

7.210, heard at 4:30 p.m. DJX, 9.675, and DXR, 11.760, Berlin, heard at 2:30 p.m. with news in English for Africa. "Voice of the United Nations," on 10.055 heard with news in English, sign-off at 3:30 p.m.; may be SUV, Cairo, Egypt. PZX3, 5.750, Paramaribo, Suriname, heard signing off at 9:46 p.m. HH2S, Port-au-Prince, Haiti, on 5.955, heard at 9 p.m. "Radio Martinique," 9.700, Fort-de-France, Martinique, "Voice of Fighting France," in the West Indies, has news in English on Tuesdays and Saturdays, 7:15 p.m. (Harris, Mass.)

The Eire stations are operated by the Department of Posts and Telegraphs, Dublin. Reception reports, however, may be sent to Leo T. McCauley, Consul General, Chrysler Building, New York 17, New York. These have been requested. The 31-meter band broadcast (9.595), approximately 5-5:30 p.m. is being heard better this spring in the East. The 17.840 frequency, 1:45-2 p.m., is working experimentally at present.

The "United Nations Radio," Algiers, 9.535, is sending in a very good signal around 5:15 p.m.

"Radio National Belge," 9.783, was heard signing on in French at 5:30 p.m. a recent evening.

JZI, 9.595, Radio Tokyo, signs on at 8 a.m. in English; puts in a good signal to the East Coast now. Signals are now much improved over JLT3, 15.225, and JUV3, 11.897, 6:15-8:15 p.m. (English, Portuguese, and Japanese are used.)

Moscow announces that it is transmitting on 6.98, 7.3, 11.88, 11.95, and 15.73, 6:48-7:25 p.m. to the United States; and at 8 p.m. on 7.3, 9.48, and 11.95. Your short-wave editor, however, has been hearing Moscow only on the Siberian transmitter, 15.23, regularly at 6:48-7:25 p.m., and occasionally on 11.95; no Moscow broadcast is picked up in West Virginia at 8 p.m.

Z(ed)NS-2, Nassau, Bahamas, is heard on 6.090, 6:30-10 p.m., relaying ZNS (640 kilocycles).

The "All-India Radio" comes in well in West Virginia with its nightly newscast in English at 9:45 p.m. on 7.275.

The "ham" station, OA4D is heard on 20 meters each Saturday at 5 p.m., working CX3CN; these are the only "hams" known to be on the air now. (Hoiermann, Ohio.)

ZLT7, 6.715, Wellington, New Zealand, is heard with news, 5:40-5:50 a.m.; weak signal.

Announcing as "Arnhem calling," a station in Germany which carries relays of AEF programs of the BBC and General Forces' programs of the BBC, as well as "Voice of America" broadcasts, is now heard from about 9 a.m. to 4 to 5 p.m. on 15.220. It puts in a good signal in West Virginia.

The Victory Radio Club reports that YI5KG, 7.090, Baghdad, is being heard weakly from 10 to 11:30 a.m.; schedule is to 4:10 p.m. That ZRG, 9.523, Johannesburg, South Africa, is heard in Afrikaans, 4:15-8 a.m. with good signal, and that ZRL, 9.598, Capetown, is heard in Afrikaans, 4-8 a.m. and 11-11:30 a.m.

The Newark Radio Club reports a station on 11.790, "The Voice of the Himilayas," location unknown, operating 3-9 a.m.

Through the courtesy of the Universal Radio DX Club, of which William "Bill" Howe is short-wave editor, here's some further late tips:

CP5, LaPaz, Bolivia, is heard 7-11:05 p.m. CFVO, Calgary, Alberta, is heard regularly with BBC news at noon. ZOJ, 11.810, Colombo, Ceylon, is scheduled 1:30-3:30 a.m. in parallel with Delhi, India. XGAP, Peiping, China, is being heard again. TGNA, Guatemala, has settled on 6.255 for the present. "Radio Shonan" (Singapore) reported on 15.865, 7:20-7:30 p.m. YSO, San Salvador, Salvador, has moved to 7.200 from 7.315. YSI is still heard on 7.040. FO8AA, 6.980, Papeete, Tahiti, is heard after midnight. Several new Soviet stations are reported, 6.230, 4:30-6:30, 7:15-7:25 p.m.; 9.280, 1 p.m., 7:15-7:25 p.m. and after 8 p.m.; 15.520, 7:15-7:25 p.m.; 16.530 is another new Moscow frequency; 11.150 heard same as 9.280. VQ7LO, 10.73, Nairobi, Kenya Colony, Africa, reported 11 a.m.-12:30 p.m. in English. XGOX, 15.18, Chungking, Wednesday, 8-8:45 a.m. (UR-DXC.)

The Edmonton, Alberta, station in the 31-meter band (approximately 9.55) is sending in a good signal here in West Virginia during the morning and early afternoon. BBC news relay is at 12 noon.

VONH, 5.980, St. John's Newfoundland, puts in an excellent signal this spring at 5:30 p.m. (announced as 7 p.m. Newfoundland Time) when a fine newscast is given.

Last-minute-tips from August Balbi, Los Angeles, follow:

Current schedule of programs to the American Forces Abroad over KROJ, Los Angeles, on 6.10 is 2-6 a.m., 9-11:45 p.m.; on 17.76, 6-8:45 p.m.; on 9.89, 12-1:45 a.m., 9 a.m.-1:30 p.m.; on 15.19, 1:30-5:45 p.m. (PWT). VUD-5, 15.19, Delhi, India, heard 10:40-11:45 p.m. XGOY, 6.14, Chungking, is now scheduled 7:35-11:40 a.m. OAX4Z, Lima, Peru, is heard 8 p.m.-12:30 a.m. MTCY, 5.71, Hsinking, Manchukuo, is heard 9:30-11 a.m. with news at beginning of transmission. "Radio Saigon," Indo-China, on 4.80, is heard 7:30-9:30 a.m.

TGWA, 15.170, Guatemala City, "La Voz de Guatemala," continues to be heard well mornings and afternoons. Good marimba band music. (Greene, Rhode Island.)

ZRK, 5.884, Capetown, South Africa, signs on at 12:45 a.m.; fades at 1 a.m.; CKRO, 6.150, Winnipeg, Manitoba, signs off at 1 a.m. COCQ, 8.83, Havana, Cuba, heard 8 p.m.-12 midnight. COCX, 9.265, Havana, Cuba, heard 7-10:30 p.m. relaying CMX (1010 kcs.). LRS, 9.32, Buenos Aires, Argentina, signs off at 11 p.m.; relays LR4. JBC, 18.135, Djarkarta or Batavia, Netherland East Indies, heard 9-10:20 p.m.;

news in English at 9 p.m. (Boehnke, Calif.)

ACKNOWLEDGMENT

Since this is the last issue of INTERNATIONAL SHORT-WAVE in RADIO NEWS for the present, your short-wave editor would like to thank each and every reader who has contributed to this department since it was instituted with the June, 1944 issue. Your cooperation has been most gratifying. Your names are being retained on my mailing list and should INTERNATIONAL SHORT-WAVE be resumed in RADIO NEWS at a later date, you will be notified. In the meantime, I should be glad to exchange tips with you—Kenneth R. Boord, 948 Stewartstown Road, Morgantown, West Virginia.

—30—

118-mc. FM Successful

(*Continued from page* 53)

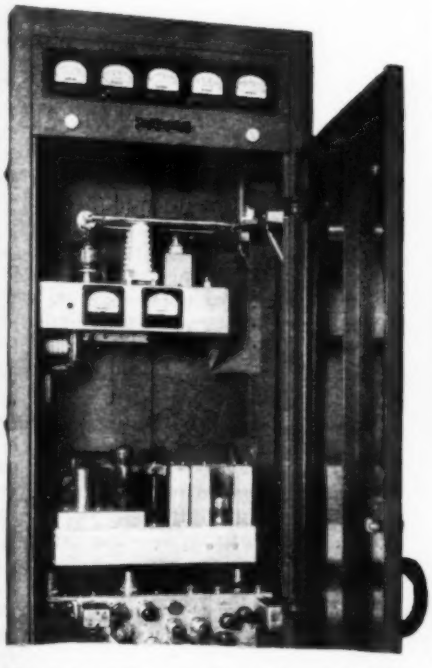
long whereas for the 30- to 40-megacycle range, a six-foot antenna is required.

The use of the 118-megacycle band permits the use of a smaller wattage than that required for the 30- to 40-megacycle frequencies; a matter of prime importance to small communities.

The following conclusion is therefore inescapable.

A whole new band of wavelengths may be utilized in the 118-megacycle spectrum for radiotelephone systems.

And, as a corollary, three frequency channels in the 118-megacycle spectrum should provide adequate radiotelephone facilities for the entire country by merely spacing wavelengths of the same frequency a 100 miles or so apart.



Top half of the experimental model, 250-watt, FM, 118.55-mc., central station unit.

—30—

If your job is different . .

the chances are you need CLARE "Custom-Built" RELAYS

● In some applications, the operation of a relay is comparatively simple. Almost any ordinary relay will do.

Clare "Custom-Built" Relays are especially designed for circuits that demand special functions . . . for use in electronic devices where the precise relay performance is a "must".

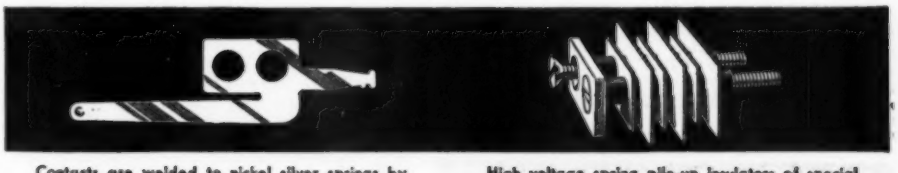
Does your circuit demand definite times for operation and release of the relay? Does it require high speed keying without contact chatter? Do you need marginal operation, which may include close pickup and dropout values? Does it call for switching of high frequency current?

All these, and many other relay requirements, are easily provided by Clare "custom-building" which permits development of a Clare Relay exactly suited to new and unusual requirements.

Radio engineers who are looking for a better, quicker, easier way to solve relay design problems are invited to send us details of their requirements. Let Clare "custom-build" a relay to your specifications. Address C. P. Clare and Co., 4719 West Sunnyside Avenue, Chicago 30, Illinois. Sales engineers in all principal cities. Cable address: CLARELAY.

Spring bushing insulators are made of Bakelite rod under patented process. Resist vibration and withstand heavy duty service.

Double arm armature assembly of stainless steel shaft, operating in a marine brass yoke. Heel piece, core and armature assembly of magnetic metal.



Contacts are welded to nickel silver springs by special process. May be of precious metals or alloys in 12 different standard, or special, types and sizes.

High voltage spring pile-up insulators of special heat treated Bakelite. Has minimum cold flow properties, low moisture absorption content, and permits punching without cracks or checks.

CLARE RELAYS

"Custom-Built" Multiple Contact Relays for Electrical, Electronic and Industrial Use

for EVERY HOBBY SHOP and HOME CRAFTSMAN!

NEW WARNER Brush ELECTROPLATER!

DECORATE Your MODELS and PROJECTS with GOLD, SILVER, NICKEL, COPPER

If you have a hobby—a home workshop—you need this new battery model Warner Electroplater. Easily and quickly, you can electroplate models and projects; you can replate worn articles, faucets, tools, silverware, etc. with beautiful coat of gleaming metal. Equipment includes 10" x 14" Control Panel, Variable Voltage Regulator, Work and Brush Terminals, Battery Connectors, Patented NYLON-LUCITE Electrolytic Brush with 4 Anodes. All necessary supplies: Electroplating Compounds for Gold, Silver, Nickel, Copper—also Degreaser, Cleanser, Instruction Book and Wiring Diagram. *Get more fun from your hobby, make your workshop complete*, order your battery model Warner Electroplater today. ONLY $19.75, shipping charge collect.

The TOOL of A 101 USES

Be proud of your work! Electroplate your models. Decorate metal projects. Replate worn objects It's easy!

DEALERS Hobby Shops Feature this new tool in your store. WRITE FOR DETAILS!

WARNER ELECTRIC CO.
Dept. A-30, 360 N. Michigan • Chicago 1, Ill.

Free!

RADIO & ELECTRONIC TEST EQUIPMENT AVAILABILITY BULLETIN

Contains detailed descriptions of models we're now making.

We manufacture Volt-Ohm Milliammeters, Insulation Testers, Signal Generators and Tracers, Industrial Analyzers, Voltage Testers, etc.

SUPERIOR INSTRUMENTS CO., Dept. 153
227 Fulton St., New York 7, N. Y.

INSTITUTES

Offer thorough training courses in all technical phases of Radio and Television

WEEKLY RATES DAYS—EVENINGS

VETERANS: RCA Institutes is approved under G. I. Bill of Rights

For Free Catalog write Dept. RN-45

RCA INSTITUTES, Inc.
A Radio Corporation of America Service
75 Varick St., New York 13, N. Y.

Specify SAUEREISEN

ACIDPROOF CEMENTS—COMPOUNDS FOR

Tanks, Sewers, Stacks, Floors
Technical cements for all purposes.

Send sketches or samples

Sauereisen Cements Company · Pittsburgh 15, Penna.

Television Receiver

(Continued from page 34)

Picture-Tube Circuit

The picture tube, in many respects similar to the ordinary oscilloscope, consists of an electron gun, fluorescent screen, and beam-deflection circuit. The electron gun used in the smaller picture tubes has the same essential elements: heater, cathode, control grid, first anode, and second anode. To properly illuminate the screen the second anode voltage has some value between five and eight thousand volts, producing a thin high-velocity beam. A typical scope circuit of a five-inch tube, as shown in Fig. 4, obtains the various electrode voltages for the electron gun from a potential divider network across the high-voltage power supply. Some of the important items to observe are as follows:

1. Control grid voltage is tapped off at a more negative point on the divider; actual bias can be varied by the brightness control, regulating the intensity of the beam which, in turn, determines the average illumination of the fluorescent screen.

2. Focus control which pin-points the electron beam on the screen, producing a thin intense beam to insure definition and clarity. The control sets the voltage ratio between second and first anode. However, this setting is influenced slightly by the brightness control and must be readjusted slightly when the average brightness is changed.

3. It is customary practice in the ordinary scope to have two of the deflection plates common (one horizontal and one vertical). In the picture tube all plates have separate connections to permit push-pull sweep excitation, insuring a more linear sweep and more convenient sweep amplification. Note how the second anode and one plate of each deflection pair obtain their potential from the junction of resistors R_1 and R_2 while each one of the remaining plates obtains its potential off the rotor of a pair of potentiometers which shunt both resistors. Thus the potential can be varied above or below the junction potential for proper centering of the image on the screen.

A greater percentage of the larger picture tubes use magnetic deflection and in some cases both magnetic deflection and focusing. A flat-faced picture tube developed by Philco which uses both magnetic deflection and focusing is shown in Fig. 2. The outstanding advantages of this type tube are as follows:

1. Fluorescent screen upon which the image appears is flat to prevent distortion of the image when looking at the picture from an angle. Useful area upon which image appears is increased.

2. Combination magnetic deflection and focusing plus flat screen and heavy glass front improves definition, contrast (light range between darkest and most brilliant point on the screen), and prevents indiscriminate distribution of light by reflection from other portions of the glass.

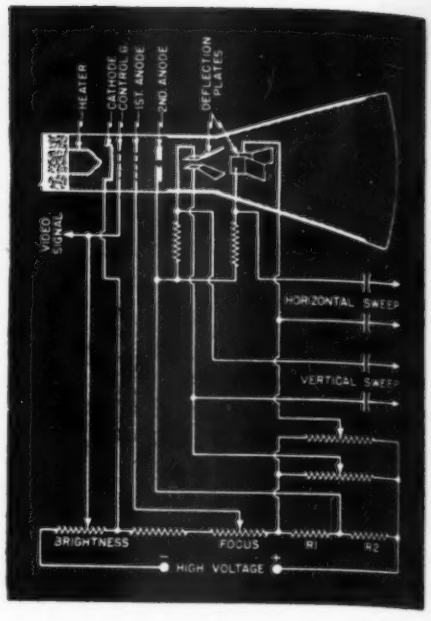


Fig. 4. Picture-tube circuit employing a 5-inch tube. To properly illuminate the screen the second anode voltage must be of a value between five and eight thousand volts, producing a thin high-velocity electron beam.

3. In many tubes a dark-brown stain appears on the fluorescent screen after a number of operating hours. This stain is permanent and is caused by the impact of negative ions which leave the cathode with the electron stream and strike the screen at high velocity. Their added mass damages the chemical composition of the screen. As can be seen in the photograph and as clearly illustrated in Fig. 2, the electron gun is mounted at an angle. This mechanical mounting plus an external bending coil causes the electron stream to bend and follow a direct line to the screen, while the heavier ions, not affected by the magnetic field of the bending coil, are dissipated when they strike the sides of the ion trap. Thus the heavy ions do not reach and damage the screen of this type tube.

The fluorescent screen of the picture tube is coated with a luminescent chemical which lights under the impact of the electrons—the more intense the beam the more brilliantly it illuminates the spot it strikes. The chemical coating, known as a phosphor, contains a nonmetal which fluoresces under impact of a cathode-ray beam and a light metal to establish a high luminous efficiency. Chemical composition also determines the color of the illumination, which for picture-tube operation, should be white with a bluish tinge. Another important factor is the persistency of the luminescent screen (how long any illuminated point glows after the passage of

the beam). It must be of sufficient persistency to prevent jerkiness and low average illumination but still short enough to prevent blurring of the image. The amplitude range of the video signal applied to the control grid must be adequate to drive the grid and fluorescent screen between black and full illumination. If the signal is too strong the screen saturates and blurs; if too weak. the contrast and light range is poor and the picture appears underexposed and washed-out.

Three external signals are applied to the scope circuit: (1) horizontal sawtooth deflection voltage to the horizontal plates, sweeping the beam from left to right and rapidly returning it to the left again: (2) vertical sawtooth deflection voltage to the vertical plates sweeping the beam more slowly from top to bottom and, then, returning it to the top: and (3) video and blanking signal to the control grid. The video and blanking signal, is negative in polarity. Consequently, when the signal reaches the high negative potential of the indicated blanking level, the control grid potential is near cut-off and the screen is blacked out for that interval. At lower amplitude points, representing the actual picture signal, the screen is illuminated for the grid has a lower bias. The spot illumination is inversely proportional to the instantaneous amplitude of the signal and the average illumination is inversely proportional to the average content of the signal.

—30—

ENEMY RADIO PROPAGANDA FALLS ON DEAF EARS

LESS than one out of every twenty U.S. radio-listener families—or less than 2% of the American public can be reached regularly by Axis propaganda, even if all short-wave receivers were capable of receiving enemy programs. This fact was learned from a recent survey of radio listeners conducted by Sylvania Electric Products, Inc.

Radio set owners in different parts of the United States and in different income groups were interviewed so that radio-listening habits could be determined as a guide to what the public will want most in the postwar.

The survey revealed that about 52 out of every 100 sets now in use may be tuned to short-waves although 37% of them are never used for short-wave reception. Even among the short-wave listeners more than half said they listen rarely or occasionally and only ten percent said they listened frequently. Evidently Americans have little or no interest in what the Axis broadcasters have to say and so much if not all of the enemy radio propaganda falls on deaf ears.

During the last war there were no voice broadcasts but a powerful enemy station dot-dashed propaganda constantly. Civilian radio receivers were outlawed for the duration, while today many Americans can listen to the enemy if they want to . . . but apparently most of them do not.

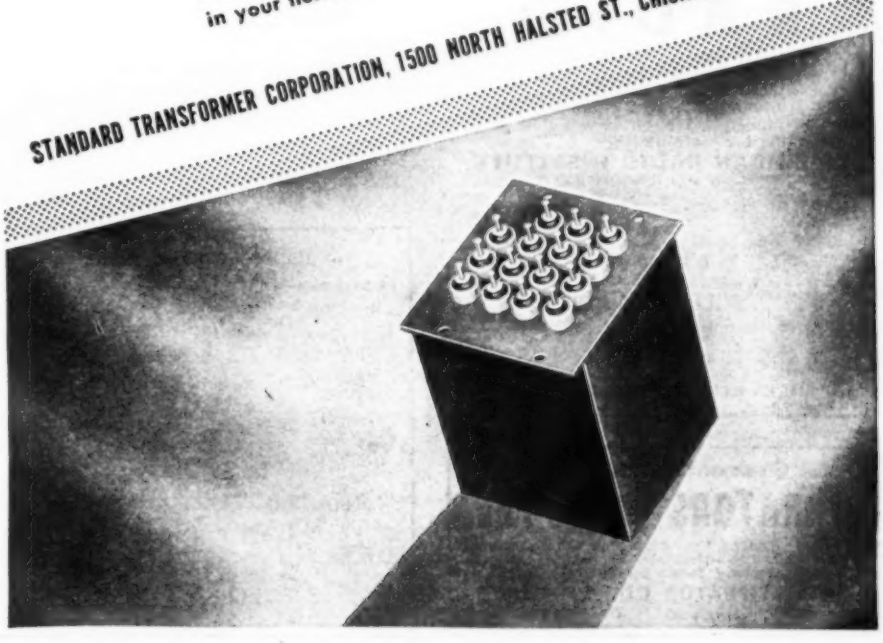
—30—

Make a "date"
WITH STANCOR NOW!

If you are streamlining for the highly competitive markets we all shall face later on, do not injure your future with a mediocre transformer . . . Consider Stancor Transformers, fabricated to perfection, bearing an enviable record of performance here and abroad.

Stancor is still on a 24-hour victory schedule, but our engineering laboratory may give you an "early date" for a joint discussion on how Stancor Transformers may play an important part in making your units "front row" in your field.

STANDARD TRANSFORMER CORPORATION, 1500 NORTH HALSTED ST., CHICAGO 22, ILLINOIS



EVERY ELECTRICAL WORKER NEEDS THIS
ELECTRICIANS 1945 HAND BOOK
For Everyday Help On The Job!
Brand new . . . up to the minute. Contains over 5,000 electrical facts—wiring diagrams—essential electrical formulas—latest code rules, tables, charts and wiring methods. Includes Industrial Electronics data. It's a gold-mine of practical, down-to-earth helps and ideas to save you time and money. A book every Electrical Worker can use every day. Pocket size, 4¼ by 7 inches, flexible leatherette cover to stand hard usage.
COYNE ELECTRICIANS HANDBOOK
400 Pages
Electrical Circuits
Reading Wiring Diagrams
Wiring Methods
Motors
Switching & Control
Illumination
Industrial Electronics, Etc.
SEE IT FREE!
See this book FREE for 7 days at my expense. If you decide you don't want to keep it, send it back and you owe nothing. If you keep the book you pay only $2.75 after 7 days' FREE examination.
FREE TRIAL COUPON
H. C. LEWIS, President
Coyne Electrical School, Dept. 45-T4
500 S. Paulina St., Chicago 12, Ill.
I want to see the New Coyne Electricians Handbook. Send me a copy for 7 days' FREE examination. If after 7 days I do not want the book I will return it and owe you nothing. If I keep it I will pay $2.75 within 7 days and the book is mine.
NAME _____ Age _____
ADDRESS _____
TOWN _____ Zone _____ STATE _____
☐ If you prefer to pay postman cash price shown above on delivery, check here. Same FREE examination & money back guarantee.

YOUR NEW FREE CATALOG IS READY FOR YOU!
Radionic's Catalog No. 26 lists hard-to-get radio parts! • Helps you fill your radio and electronic needs. • All parts are available for immediate shipment • All are highest quality. • All are exceptional values.
SEND TODAY FOR YOUR FREE COPY TO
RADIONIC EQUIPMENT CO., Dept. 2A
CHANCELLOR PRODUCTS
170 NASSAU STREET, NEW YORK 7, N. Y.

RADIO
Courses Qualifying for
Service Technician—Laboratory Technician
(Electronic Television)
Communications Operator
Consideration given to Veterans
eligible for training under G. I. Bill.
AMERICAN RADIO INSTITUTE
101 West 63d St., New York 23, N. Y.

FILMGRAPH
"MILES AHEAD OF OTHERS"
Miles Filmgraph Recorder-Reproducer affords instantaneous recordings and playback of speeches, interviews, dictation, verbal agreements and many useful functions.
Write for Bulletin and further details.
MILES REPRODUCER CO., Inc.
812 Broadway (Dept. RN-4) New York 3

Guaranteed Rebuilt
VIBRATORS—$1.00 ea.
Send old vibrator. For very prompt delivery, enclose remittance and return postage. We rebuild any make or kind of vibrator or relay. Send your old vibrator to
BEST VIBRATOR CO., Box 5802
Cleveland 1, Ohio

Impedance Meter

(*Continued from page 39*)

The 6.3-v. transformer is internally mounted on one edge of the chassis.

The changeover switch is a *heavy-duty* toggle-type component, and is connected by heavy insulated leads to the other parts. It is entirely permissible to employ a rotary switch in this position. Single- and double-lug terminal strips are provided at various points for circuit connections. The wiring is simple, for the most part is made directly between components, and requires only a few tie points for rigidity. Cabling is recommended. Heavy insulated conductors must be employed.

The entire impedance meter may be built into an audio oscillator cabinet, provided there is ample room on the chassis and front panel of that instrument. In this way, the signal voltage source may be made integral with the impedance meter without interfering with normal uses of the oscillator.

Calibration

After the wiring of the impedance meter has been checked and corrected, the instrument may be calibrated according to the following procedure:

1. Connect signal voltage source. (This is preferably an audio oscillator delivering 75-volts r.m.s. or higher at 500 cycles, but may be 60-cycle power line);
2. Throw switch to *high*;
3. Connect terminals X-X temporarily together by means of jumper or test leads;
4. Adjust potentiometer R_2 for exact full-scale deflection of milliammeter;
5. Connect accurately-known 10-ohm noninductive resistor to X-X terminals, noting milliammeter deflection;
6. Mark this deflection 10 on meter scale;
7. Repeat with accurately-known noninductive resistors, corresponding to 10-ohm intervals from 20 to 140 ohms, 50-ohm intervals from 150 to 1000 ohms, and 100-ohm intervals from 1100 to 10,000 ohms (mark each value on meter scale);
8. Throw switch to *low*, and set potentiometer R_2 for full-scale milliammeter deflection—with no jumper between terminals X-X;
9. Connect accurately-known 1-ohm noninductive resistor to X-X terminals, marking corresponding deflection 1 on meter scale;
10. Repeat, using accurately-known noninductive resistors corresponding to 1-ohm intervals between 2 and 10 ohms, and 5-ohm intervals between 15 and 100 ohms.

During the calibration process, the "zero setting" of the meter must be inspected regularly, making any change in the setting of the potentiometer, R_2, required to restore the initial full-scale deflection (with terminals X-X shorted when switch is at *high*, and left open when switch is at *low*).

Accuracy of the calibration will depend upon the care exercised in taking resistor readings and in marking-off the meter scale, and the closeness to which the test-resistor values are known. The best calibration resistors will be precision, noninductive, wire-wound instrument resistors (rated at 1%, .5%, or .1% accuracy) or a laboratory decade box. When these are not available, a volume-control-type rheostat of suitable range may be set successively to the various resistance values specified in the calibration procedure, and checked by means of a Wheatstone bridge or a *good* ohmmeter.

A direct-reading meter scale is desirable, since it will permit quick reading of impedance values. Nevertheless, some builders will not choose to prepare a special scale for the meter, but will be satisfied with a chart for converting milliammeter reading into impedance values. A sample chart of this sort, prepared for the author's instrument, is shown in Table I.

The direct-reading impedance meter is as simple to use as a common d.c. ohmmeter. The following methods of procedure are recommended in measuring impedance:

High impedance (100-10,000 ohms).

Table 1. Sample calibration for the direct-reading impedance meter. (Indicating instrument—Weston Model 301, 0-1 a.c. milliammeter.)

SERIES CONNECTION		PARALLEL CONNECTION	
Impedance in ohms	Ma.	Impedance in ohms	Ma.
10,000	0.07	1	0.05
5000	0.1	2	0.12
3000	0.19	3	0.19
2000	0.26	4	0.26
1000	0.40	5	0.32
500	0.57	6	0.37
300	0.69	10	0.51
250	0.71	20	0.69
200	0.75	30	0.77
100	0.85	40	0.83
50	0.91	50	0.85
30	0.95	60	0.88
20	0.96	100	0.93
10	0.98		

(1) Connect a.c. voltage source to instrument: (2) Throw switch to *high;* (3) Connect X-X terminals temporarily together and adjust potentiometer R_2 for full-scale meter deflection; (4) Remove jumper from X-X terminals and connect in its place the unknown impedance; (5) Read impedance value on meter scale.

Low impedance (1-100 ohms). (1) Connect a.c. voltage source; (2) Throw switch to *low;* (3) With X-X terminals *left open,* adjust potentiometer R_2 for full-scale deflection of meter; (4) Connect unknown impedance to X-X terminals by short, heavy leads; (5) Read impedance value on meter scale.

Scope of Impedance Meter

The impedance meter described in this article will allow the serviceman and experimenter to check quickly and with sufficient accuracy for most purposes the impedance of coils, capacitors, transformers, loudspeakers, headphones, chokes, lamps, resistors, a.f. tuned circuits, filters, and similar components at frequencies between 60 and 1000 cycles. The measurement frequency may be extended into the region 1000-to-10,000 cycles, provided corrections are made for high-frequency error. (The meter reading might be expected to be lower than true value by approximately .5% per 1000 cycles. This is due to the characteristic of the oxide rectifier).

-30-

HAMFESTERS CLUB

THE Hamfesters Radio Club, world's largest organization of licensed radio amateurs, held its annual election of officers on Friday, January 19th, at the regular monthly meeting at Chicago. The new officers are: President, W. S. Soich, W9HXW, 6225 S. Bishop; Vice-president, C. T. Read, W9AA, 507 W. 62nd; Secretary, J. P. Gavin, W9YES, 7841 S. Green; Treasurer, E. J. Stanley, W9DXU, 8415 S. Wabash; Sergeant-at-Arms, V. Knitter, W9ABR, 1265 W. 71st, all of Chicago.

Hamfesters is one of the few amateur radio clubs in the country to continue regular meetings during the war. The club's service flag now has 103 blue stars and 2 gold stars, representing members who have placed their expert radio knowledge at the service of their country. In addition to the men actually in uniform, many of the club's older members are now working in radio laboratories and factories. This is generally true of all licensed radio amateurs today. A majority of the nation's 60,000 hams are either in the service or have left their normal employment to devote the special skills acquired through years of practical experience to the design and manufacture of vital electronic equipment.

One of the club's most valuable activities during these days when all regular amateur operation is temporarily suspended is in promoting correspondence with the members in the service. A regular system has been set up to insure that each absent member is kept supplied with letters from home.

-30-

NOW AVAILABLE
(without priority)
Duotone Aluminum Base Recording Blanks!
Retailers are invited to avail themselves of this new, improved, high-quality aluminum base, nitrate coated recording blank—now available for the first time without priority! Duotone's mass production facilities place us in the position of accommodating your requirements without delay. Write today for specific prices and literature. Immediate deliveries.
RELATED PRODUCTS: Duotone Cutting Needles for better cutting quality; Duotone Hardening Fluid which preserves the recording; the Duotone "Star" Sapphire; Shadowgraphed Transcription Needles for quality playbacks.
Duotone
DUOTONE COMPANY, 799 BROADWAY, NEW YORK 3, N. Y.
Makers of the Five Dollar "Star" Sapphire Needle

VACUUM TUBE DESIGNER

An Eastern manufacturer has an attractive opportunity for a graduate physicist or electrical engineer with several years of practical experience in vacuum tube design. It is necessary that applicants have sufficient production experience to develop designs which will improve quality and reduce cost through lowered shrinkage.

Furnish full details regarding experience, education, age, and salary requirements.

BOX 391, RADIO NEWS
540 N. Michigan Ave.
Chicago 11, Ill.

Transmitting or Receiving

RADIO STATION TECHNICIANS

MEN AND WOMEN

for Point-to-Point International Radio-communications Stations in the United States.

Applicants must possess at least Second Class commercial Radiotelegraph Operator's License.

Essential workers need release statement.

Apply weekdays except Saturdays between 10 am and 3 pm or write

PERSONNEL DEPARTMENT
R.C.A. COMMUNICATIONS, Inc.
64 Broad Street
NEW YORK 4, N. Y.

WANTED! DEVELOPMENT AND DESIGN ENGINEERS—EXPERIENCED IN RADIO, RADAR AND U.H.F. DETAILED RESUMÉ OF QUALIFICATIONS REQUIRED. WRITE BOX 395, % RADIO NEWS 540 N. MICHIGAN

INDUSTRIAL MAN-POWER BUREAU

ENGINEERS....

Are You Concerned With YOUR POST WAR FUTURE?

The Federal Telephone & Radio Corporation, the manufacturing unit of the International Telephone & Telegraph Corporation with its multiple business activities extending to all parts of the civilized world, will accept applications from experienced men for immediate employment with almost limitless post war possibilities. These positions should interest those with an eye to the future and whose interest lies in forging ahead with this internationally known organization whose expansion plans for post war are of great magnitude covering all types of radio & telephone communications. Advancement as rapid as ability warrants. Majority of positions are located in the New York area! Essential workers need release statement.

We need the following personnel! Men with long experience or recent graduates considered.

- *ENGINEERS*
  - ELECTRONICS
  - ELECTRICAL
  - RADIO
  - MECHANICAL
  - CHEMICAL
  - TRANSFORMER DESIGN
- SALES AND APPLICATION ENGINEERS
  - PHYSICISTS
  - DESIGNERS
  - DRAFTSMEN
  - TOOL DESIGNERS
  - TECHNICAL WRITERS

Look Ahead With Federal!

If inconvenient to apply in person; write letter in full; detailing about yourself; education, experience, age, etc.; to Personnel Manager.

FEDERAL TELEPHONE & RADIO CORP.
39 Central Avenue
EAST NEWARK NEW JERSEY

FIELD SERVICE ENGINEERS

FOR DOMESTIC AND FOREIGN SERVICE
MUST POSSESS GOOD KNOWLEDGE OF RADIO

Essential workers need release

HAZELTINE CORPORATION
58-25 Little Neck Parkway
Little Neck, Long Island, N. Y.

---

urgently needed!

TRANSFORMER DESIGN

ENGINEER

With five years recent experience in design of (1) hermetically sealed transformers and reactors used in war equipment; (2) low-cost transformers for home receivers. Willing to work in Southern Conn. Salary open. Write details to Personnel Mgr. today.

MAGUIRE INDUSTRIES, INC.
Electronics Division
342 W. Putnam Ave., Greenwich, Conn.

"RADIO SALESMEN AND PURCHASE ORDER CLERKS"

thoroughly familiar with all types of radio parts, for sales counter and purchasing dept. Permanent position; good salary to the right men. Positions open in Chicago and Atlanta. Box 394, % Radio News, 540 N. Michigan Ave.

WANTED

RADIO LICENSED AMATEURS

thoroughly familiar with all types of parts, tubes, meters, test equipment, receivers, transmitters, etc., capable of dealing with our industrial accounts. Permanent position; excellent salary; splendid opportunity for some one residing in metropolitan New York area.

SUN RADIO & ELECTRONICS CO.
212 Fulton St. New York 7, N. Y.

"This section is designed to help the radio industry obtain trained, experienced, technical men to facilitate vital war production. Before applying for any of these positions consult your local United States Employment Service office to determine War Manpower Commission regulations concerning the changing of jobs. If you are already employed in war work at your highest skill, stick to your present job."

IS *Your* OPPORTUNITY HERE?

Think this over carefully. Where do you go from the spot you're in now? Are your surroundings friendly and full of promise for the future? Consider now the place you might fill in the electronic industry leadership assured to the fine staff of engineers, scientists, technicians at NATIONAL UNION RADIO CORPORATION. We're all young in years and ideas though most of us are old in electronic experience. We enjoy working together. We know we're going places! We're inviting you to join us if you have the qualifications. If you're looking for a success pattern for your future, it may be here with us at National Union. Find out! Come in and talk it over or write us!

NATIONAL UNION WANTS:

* **QUALITY CONTROL ENGINEER AND SENIOR TUBE ENGINEERS**—These men MUST have executive ability and extensive experience with radio tube manufacture. The pay and opportunities are commensurate with your ability.
* **COMMERCIAL ENGINEERS**—Men with pleasing personalities, initiative and a knowledge of vacuum tube applications.
* **TEST EQUIPMENT ENGINEERS**—Men with special interest in circuit design and applications.
* **QUALITY CONTROL MEN**—Statistical Training is chief requirement though a knowledge of vacuum tubes will help.
* **JUNIOR ENGINEERS**—MEN or WOMEN—If you have a college degree in Physics, Electrical Engineering, Mathematics or Chemistry and are the type of young person who is able to 'go places,' you'll be starting with your best foot forward if you are accepted at National Union Radio Corporation.
* **FOREMEN and ASSISTANT FOREMEN**—Men with foremanship experience in exhaust, stem or grid operations in radio tube manufacture.
* **TECHNICIANS, CIRCUIT MEN**—Maybe you've been repairing radios, maybe you've gained a knowledge of circuits by working on test equipment. It makes no difference either way if you have the 'know how' of circuits write us about the opportunities we have to offer!

WOMEN!

We have a number of fine young women engineers with us now. We need more. If you have a degree in Electrical Engineering, Physics, Chemistry or Mathematics and are seeking career opportunities, investigate.

Phone or Write

DR. L. GRANT HECTOR

Director of Engineering

NATIONAL UNION RADIO CORPORATION

RESEARCH LABORATORIES

Plane St. at Raymond Blvd.
Newark 2, New Jersey
WMC RULES OBSERVED

Wanted
ENGINEERS

Radio
*** Electrical**
Electronic
*** Mechanical**
*** Factory Planning**
Materials Handling
Manufacturing Planning

Work in connection with the manufacture of a wide variety of new and advanced types of communications equipment and special electronic products.

Apply (or write), giving full qualifications, to:

R.L.D., EMPLOYMENT DEPT.

Western Electric Co.

100 CENTRAL AV., KEARNY, N. J.

***Also: C.A.L.**
Locust St., Haverhill, Mass.

Applicants must comply with WMC regulations

HELP WANTED

SMALL ELECTRIC MOTOR'S
ENGINEERS
DESIGNERS
DRAFTSMAN
TECHNICIANS
TOOL MEN

For Wartime and Postwar Work—Growing Organization—WMC Rules Apply—Write Giving Details About Age, Experience, Past Salaries, Etc.

To ALLIANCE MANUFACTURING CO.

ALLIANCE, OHIO

225 Bendix Interphone Amplifiers

Model 3611 & 3611B equipped with Pioneer Dynamotor 24v., 1.2 amps input 220v., .06 amps output (2 tubes; 1—6SJ7 & 1—6V6). New, complete with tubes. Can be used for aviation, cars, boats, etc. Will sell at very low cost individually or in lot.
Box No. 393, c/o RADIO NEWS, 540 N. Michigan, Chicago 11.

RADIO TECHNICIAN

Wanted:—Man with Ham or Service background for work on interesting Electronic Equipment. Write giving full details, age, experience, training, etc. WMC Rules observed. Transportation paid.

TECH LABORATORIES

337 Central Avenue, Jersey City, 7, New Jersey

RADIO

Research & Development

Exceptional opportunity for young technically trained radio man to join the research staff of large, progressive company. This is a permanent position with splendid postwar future. Starting salary $172.50 to $200.00 per month based upon experience. Assurance of substantial earnings. For a personal interview please give us (in complete confidence) your educational and technical background, age, religion and draft status. Our own organization knows of this advertisement.

Reply
c/o RADIO NEWS Box 390

· INDUSTRIAL · MAN-POWER BUREAU

Continued

HELP WANTED

TRANSFORMER & SMALL ELECTRIC MOTOR MEN

ENGINEERS
DESIGNERS
DRAFTSMEN
TECHNICIANS

For war time and post-war design and development of intricate, specialized, hermetically sealed transformers, and special purpose fractional h.p. motors.

Write, giving details about age, experience, past salaries to

SPERRY
GYROSCOPE COMPANY, INC.
RESEARCH LABORATORIES
STEWART AVE. AND CLINTON RD.
GARDEN CITY, NEW YORK

PRODUCT ENGINEERS

A progressive manufacturer of electrical products needs five product engineers to do trouble shooting, shrinkage analysis, materials engineering, etc.

Applicants for these positions should have a degree in either electrical engineering or physics and at least five years' engineering experience of an important nature, requiring the use of independent judgment and thorough-going analysis of electrical engineering problems.

Early interviews will be arranged for qualified applicants furnishing full details regarding age, education, experience and salary requirements.

BOX 392, RADIO NEWS
540 N. Michigan Ave., Chicago 11, Ill.

Opportunities
IN PRESENT AND POSTWAR WORK

Senior and Junior graduate engineers with one or more years radio experience wanted by an expanding manufacturing division of an established communication company.

Present activities include high and medium power transmitters, frequency shifters, other communication products for the Navy and designs and models for postwar use.

Engineers with practical experience also required for radio communication plant installation and test in foreign countries.

Phone, call or write stating experience, education, present salary, etc., to

PRESS WIRELESS, INC.

HICKSVILLE, L. I.

ATT.: S. A. BARONE **CHIEF MFG. ENGR.**

Classified

Rate 20c per word, Minimum, 10 words

RADIO ENGINEERING

RADIO Engineering, Broadcasting, Aviation and Police Radio, Servicing, Marine Operating and Electronics taught thoroughly. Expenses low. Write for catalog. Valparaiso Technical Institute, Dept. N, Valparaiso, Ind.

PATENT ATTORNEYS

INVENTORS—Before disclosing your invention to anyone, send for Form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and Instructions. Sent free. Lancaster, Allwine & Rommel, 414 Bowen Building, Washington 5, D. C.

PATENTS SECURED. Two valuable booklets sent free. Write immediately. Victor J. Evans & Co., 948-D Merlin Bldg., Washington 6, D. C.

RANDOLPH & Beavers: Registered Patent Attorneys, 331-E Columbian Building, Washington, D. C. In order to Protect your invention and reap the reward that should be yours, Patent your invention without delay, and at the same time have Rights to sell as Manufacturers convert to Civilian Production. Write for Information and Record Form Today.

RADIO EQUIPMENT

RADIO Service men and experimenters send for our giant radio catalogue. Save dollars. United Radio Co., (1000M) Newark, N. J.

RADIO Repair. Locate minor radio troubles. Send for copy "Minor Radio Troubles." Mail 25c to Radio, Box 311, Benton Harbor, Mich.

RESISTOR Kit—20 Resistors, includes five wire wound vitrolite 10 Watt and five wire wound 5 Watt of assorted commonly used values. Sent C.O.D., $2.00. 1110R Marshall Bldg., Cleveland, Ohio.

CORRESPONDENCE COURSES

PREPARE now for tremendous opportunities in new fields of Radio after the war. Training for Federal licenses. Write for particulars. American Radio Institute, 44 East 23rd St., New York 10, N. Y.

USED Correspondence Courses and Educational Books sold or rented. Inexpensive. Money-back guarantee. Write for Free Catalog listing 4000 bargains.—(Courses Bought.)—Lee Mountain, Pisgah, Ala.

CORRESPONDENCE Courses and self-instruction books, slightly used. Sold. Rented. Exchanged. All subjects. Satisfaction guaranteed. Cash paid for used courses. Complete information and 92-page illustrated bargain catalog FREE. Write Nelson Company, Dept. 2-59, Chicago 4.

FOR SALE

SELENIUM Rectifiers—half wave, 4½ Amperes, 10 volts, $4.50, Full Wave, ½ Ampere, 10 volts, $1.85, 30 Volts, 1 Ampere, $3.49, Schematic of A.B. Eliminator using ½ Ampere Rectifier, 25c. Free with order, list free. Milton Bursma, 105 Avondale, Jackson, Mich.

BUZZER Code Practice set complete with key, battery and instructions. Sends real wireless signals. Only $1.65. Two sets $3.00. Guaranteed. Rathert Electric, Dept. N, Cresco, Iowa.

UNIVERSAL Midget Tools: Dandy Sixteen Piece Set: Midget Pliers, Diagonal Cutters, Four Midget End Wrenches, Needle-nose Pliers, Screwholder, Six Punches & Chisel, Round File, Midget Crescent Wrench. $14.85. Immediate delivery; Remit Today; Catalog Free with Order. Dealers Tool Supply, 1527 Grand RN, Kansas City, Mo.

YOUR New Free Catalog is Ready! Radionic's Catalog No. 26 lists hard-to-get radio parts. All available for immediate shipment. Send today to: Radionic Equipment Co., Dept. 4B, 170 Nassau St., New York 7, N. Y.

BUILD a radio, complete kit with tubes, $10.95, details. Radio, 9418a Avenue "A," Brooklyn, N.Y.

LOWEST Prices. Radio Tubes, parts. Bargain lists 3c. Potter, 1314 McGee, Kansas City 6, Mo.

SELENIUM Rectifiers. Immediate shipment to industrial users—laboratories. Twelve plate half-wave assembled units rated single phase 220 volt, 75 milliamperes continuous duty at 35° C. ambient temperature. Price, each, $2.80. Each prepaid. Four units make a full wave 220 volt single phase bridge circuit rectifier rated 150 milliamperes. Six units a full wave 220 volt three phase bridge circuit rectifier rated 225 milliamperes. Discount on Quantities. J. E. Robin, Inc., 330 W. 42 St., New York 18, N. Y.

HEAD Phones: Latest type—Light weight, Finest Quality, with plug for tuning in on radio, 2000 Ohm resistance. Slightly used sets, without head bands, $1.25; With leather covered adjustable head bands, $2.50; New sets without head bands, $1.75; New sets—with leather covered adjustable head bands and rubber covers, $3.75. Add 25c for mailing. Send money order—Quantity Limited. Department C, Nico Supply Co., 540 N. 17th St., Philadelphia 30, Pa.

MISCELLANEOUS

THOUSANDS of Electric Clocks out of service needing repairs. Our easy to learn home-study course teaches you how to quickly repair these clocks. Write for free information. Electronic Supply Co., P. O. Box 2350M, Houston 1, Texas.

50L6-35Z5-12A8-12SA7-12K7, etc. repaired. Fully tested after repairing in radios. 25c each, 20 Tubes repaired, $4.00. Minimum order $2.00. Open filaments repaired. Prompt service. Send no money. Repaired Tubes returned C.O.D. Flashed, exploded or open Cathodes rejected. Radio Service, 307 Pipestone, Benton Harbor, Mich.

MAGAZINES (back dated) — foreign, domestic, arts. Books, booklets, subscriptions, pin-ups, etc. Catalog 10c (refunded). Cicerone's, 863 First Ave., New York 17, N. Y.

MYCALEX—Perfect UHF insulating medium, 3/32" thick. Can be cut, drilled, machined, etc., 10 pounds, $2.00. Sent C.O.D. 1110R Marshall Bldg., Cleveland, Ohio.

WANTED

SONG Poems wanted to be set to music. Send poem for immediate consideration. Five Star Music Masters, 420 Beacon Bldg., Boston 8, Mass.

SHORT Wave Radio-Hallicrafter SX28A Preferred. Box 124, Somerset, Ky.

USED self-contained recorder or recording attachment, any make, ready to use. Address Aupied, 1669 N. Dorgenois, New Orleans, La.

WILL pay cash for Roto Ranger meter. Prefer Model 202. State price and describe condition of instrument. Thompson Radio, Crookston, Minn.

WANTED: Electric Eye Set. Robert Uline, 17 Ralph St., Ballston Spa, N. Y.

RECORDING Head Magnetic 8 or 10 Ohms, Webster or Astatic, etc. Also Recording Unit with Magnetic Head. Will pay cash. John J. Musser, Bowmansville, Pa.

In the Rocky Mountain Region
it's
RADIO & TELEVISION SUPPLY CO.
810 EUCLID AVE., PUEBLO, COLO.
"If we don't have it, we'll get it—or it can't be had! Phone 5729"

COMMERCIAL RADIO INSTITUTE
A radio Training center for over twenty-four years.
RESIDENT COURSES ONLY.
Pre-Induction, Broadcast, Marine Telegraphy, Aeronautical, Television, Service. Classes now forming for June 18th. Literature upon request.
Dept. D., 38 W. Biddle St.
Baltimore 1, Md.

Photo Credits

Page	Credit
25, 26, 27	U.S. AAF
30	Cinaudagraph Speakers, Inc.
31	RCA
33 (top)	GE
33 (bottom)	Philco
35	Fairchild
46, 47 (top left)	Army Service Forces
47 (top right)	U. S. Marine Corps
47 (bottom) 146	U. S. Army Signal Corps
52, 53, 151	Galvin
64	Harco
80	Acme-U.S. Army Signal Corps
124	North American Philips
136	Press Wireless

Spot News

(*Continued from page* 148)

Thus, if the dealer expects to sell 100,000 sets in the first year, each set assumes a share of the cost of the film or about seven and a half cents.

Continuing this analysis, Mr. Austrian said: "On a fifty-fifty cooperative basis, which is customary in the radio business, the dealer agrees to pay for the use of this film; $3.75, on the basis of his sales quota being set at, let us say, 100 receivers. The manufacturer pays the balance.

"One film every other week will cost annually $195,000, of which the manufacturer pays half. Not an unreasonable outlay considering the ultimate goal he is after . . . the sale of millions of sets. How would this program of twenty-six films from one manufacturer fit the dealer's problem? Let's assume he subscribes to 26 films at $3.75 each. That's a total of $97.50. His hundred set quota figure, on an average retail price per set of $175 is $17,500. The advertising expenditure therefore is only a fraction over one-half of one per cent."

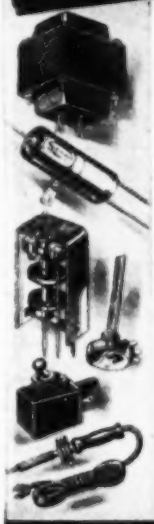
Subscription systems have also been suggested as a means of providing audiences and increased programs. Methods cover wired links and radio tieups using a scrambler. The scrambler would ruin the picture unless the receiver were equipped with an unscrambling unit that would be rented from the service. Fees of from ten to fifty cents have been proposed for the scrambling or wired services.

Personals

Captain J. B. Dow, USN, is now the director of electronics in the Bureau of Ships. This supersedes the older radio division . . . **Niles Trammel,** president of NBC, has succeeded **General Charles G. Dawes** on the RCA board of directors. **Frank M. Folsom,** RCA vice president, has been elected a director of the NBC board, replacing General Dawes in that post . . . **Samuel H. Cuff,** general manager of the DuMont television station, has been scheduled to conduct a lab course on the techniques of television at New York University . . . **Henry A. Stephens** is now advertising and publicity manager at Hudson American . . . **Frank J. Bingley,** chief television engineer of Philco, is now a vice president of TBA, succeeding **R. L. Gibson** of G.E. . . . **Colonel Don C. McRae** is back at Eastern Air Lines as superintendent of communications. He had been in the Armed Forces since 1942 . . . **Dr. Frederick C. Terman,** well-known radio engineering text-book author, has been named dean of the Stanford University School of Engineering. At present, Dr. Terman is at MIT, in charge of the radio research laboratory . . . **Adolph Gross** will head the New York branch of Newark Electric Company.

—30—

RADOLEK
Radio–Electronic Service Parts

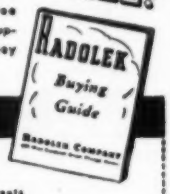


Large stocks assure the finest and most complete selections of all available items at lowest prevailing prices. Thousands of active buyers depend on us for their entire Radio repair and replacement requirements. Because we understand service problems, every order is expedited for delivery in double quick time. Everything we do is planned for convenience and satisfaction to our customers. You will find it profitable to make Radolek your buying headquarters.

FREE BUYING GUIDES

Because of existing conditions we keep our customers right up to the minute on available merchandise by releasing supplements frequently instead of sending our regular Big Profit Guide once a year. Send the coupon now to get these Free Buying Guide Supplements as they are issued.

FREE!



FAST SERVICE!
RADOLEK CO., Dept. B-101
601 W. Randolph St., Chicago 6, Ill.
Please send FREE Buying Guide Supplements
NAME _____
ADDRESS _____
ORDER FROM RADOLEK

A METER on the *Sidelines* *can't Carry the Ball!*

Let Alpha Meter Repair Specialists put your meter back in the Game.

METER-O-LOGICS

Testing equipment in our Repair Laboratories is checked periodically by the National Bureau of Standards at Washington.

Your inquiries are invited on meter repair . . . as well as meter conversion.

Be sure to enclose priority. If you have none, apply at your regional W.P.B.

Alpha Meter Service
division of
ELECTRONIC DEVELOPMENT LABS.
71 Nassau Street, New York 7, N. Y.

INDEX OF Advertisers

April 1945

COMPANY	AGENCY	PAGE No.
Aerovox Corporation	Austin C. Lescarboura & Staff	161
Alden Products Company		143
Alliance Manufacturing Company	Campbell-Sanford Adv. Co.	106, 157
Allied Radio Corporation	Henry H. Teplitz	9, 60
Alpha Meter Service	Rill Associates	159
American Phenolic Corporation	Evans Associates, Inc.	99
American Radio Hardware Co., Inc.	Shappe-Wilkes, Inc.	89
American Radio Institute	Sternfield-Godley, Inc.	154
Atlas Sound Corporation	Rill Associates	110
Audak Company	Hart Lehman	8
Audel, Theo., & Co., Publishers	Grant & Wadsworth, Inc.	111
Bell Telephone Laboratories	N. W. Ayer & Son, Inc.	67
Belmont Radio Corporation	Beaumont & Hohman, Inc.	117
Best Vibrator Co		154
Bliley Electric Company	Hardy Advertising	21
Brush Development Company, The	Gregory Advertising, Inc.	11
Burgess Battery Company	Howard H. Monk & Associates	92
Burstein-Applebee Co	Frank E. Whalen Adv. Co.	140
Candler System Company	Van De Mark Adv., Inc.	130
Capitol Radio Engineering Institute	Henry J. Kaufman, Advertising	83
Caudagraph Speakers, Inc.	Michael F. Mayger, Advertising	116
Clare, C. P., & Co	Hamilton Adv. Agency, Inc.	151
Commercial Radio Institute		159
Concord Radio Corporation	E. H. Brown Advertising Agency	66
Connecticut Telephone & Elec. Div.	Wilson & Haight, Inc.	20
Consolidated Radio Products Co.	Burton Browne Advertising	70
Cornell-Dubilier Electric Corp.	Reiss Advertising	109
Cornish Wire Company, Inc.	Hart Lehman	140
Coyne Electrical School	McJunkin Advertising Co.	126, 128
Coyne Electrical School	The Phil Gordon Agency	150, 154
DeForest's Training, Inc.	MacDonald-Cook Company	15
Delco Radio Div., General Motors	Campbell-Ewald Company	162
Drake Electric Works, Inc.	William Hoffman & Associates	136
Duotone Company	Maxon, Inc.	155
DuMont, Allen B., Laboratories, Inc.	Austin C. Lescarboura & Staff	139
Eastern Amplifier Corporation	Roberts & Reimers, Inc.	77
Echophone Radio Co.	Burton Browne Advertising	97
Electro-Voice Corporation	Shappe-Wilkes, Inc.	94
Fada Radio & Electric Co., Inc.	Sternfield-Godley, Inc.	6
Federal Telephone & Radio Corp.	Commerce Advertising Agency.	156
Federal Telephone & Radio Corp.	Marschalk & Pratt Co.	17, 81
Freed Transformer Company	Franklin Advertising Service	118
Gates Radio Company	Henry J. Kaufman, Advertising	135
Gateway Publishing Company	Louis B. Didier	136
General Cement Mfg. Co.	Turner Advertising Agency	122
General Ceramics & Steatite Corp.	O. S. Tyson & Company, Inc.	137
General Test Equipment Co.	Suzanne Hayman Advertising	150
Gothard Manufacturing Company	Merchandising Advertisers	126
Greenlee Tool Co.	Howard H. Monk & Associates	132
Guardian Electric	Kennedy & Company	127
Hallicrafters Company, The	Burton Browne Advertising	5
Hammarlund Mfg. Co., Inc., The	Roeding & Arnold, Inc.	24
Harco Steel Construction Co.	Lewis Advertising Agency	144
Harvey Radio Company	Shappe-Wilkes, Inc.	112
Hazeltine Corporation	Equity Advertising Agency	156
Howard Manufacturing Corp.	Bozell & Jacobs	106
Hytron Corporation	Henry A. Loudon Advertising	10
Illinois Condenser Company	Sander Rodkin Adv. Agency	146
International Detrola Corporation	Zimmer-Keller, Inc.	102
Islip Radio Mfg. Corporation	Kotula Company	132
Jensen Radio Manufacturing Co.	Burton Browne Advertising	7
Johnson, E. F., Company	David, Inc.	18, 113
Kaar Engineering Co.	The Conner Company	115
Kato Engineering Co.		144
Kelnor Manufacturing Company	Kelso Norman Advertising	134
Knights Co., The James	Turner Advertising Agency	82
Kurz-Kasch, Inc.	Kircher, Lytle, Helton & Collett	133
Lake Radio Sales Co.	Sander Rodkin Adv. Agency	120
Lechtrohm, Inc.	Merchandising Advertisers	148
Lectrolab Products	Sander Rodkin Adv. Agency	116
Lifetime Sound Equipment Co.		142
Lincoln Engineering School	Buchanan, Thomas Adv. Co.	150
Maguire Industries, Inc.	Park City Adv. Agency, Inc.	156
Mallory, P. R. & Co., Inc.	Aitkin-Kynett Co.	87
Meck, John Industries	The Fensholt Company	2nd Cover
Meissner Manufacturing Company	Gardner Advertising Company	125
Merit Coil & Transformer Corp.	Merrill Symonds	147
Micamold Radio Corporation	Hart Lehman	148
Miles Reproducer Co., Inc.	Altomari Advertising Agency	154
Millen, James Mfg. Co., Inc.	James Millen, Inc.	12
Murdock, Wm. J. Co.	John A. Smith & Staff	78
McElroy Manufacturing Corp.	Shappe-Wilkes, Inc.	128
McGraw-Hill Book Co.		130
National Company	Graydon Smith	63
National Electronic Supply	Louis B. Didier	78
National Radio Institute	Vansant, Dugdale & Co., Inc.	3
National Schools	The Mayers Company	73
National Union Radio Corporation	Hutchins Adv. Company	85, 157
Nelson Co.	A. N. Baker Adv. Agency, Inc.	108
Newcomb Audio Products Co.	Gail Hall Advertising	148
Ohmite Manufacturing Co.	Henry H. Teplitz	93
Olson Radio Warehouse	Jessop Advertising Co.	138
Olympic Tool & Manufacturing Co.	George Homer Martin	134
Onan, D. W. & Sons	Graves & Associates	122
Paul's Radio Accessories		120
Permoflux Corporation	Turner Advertising Agency	149
Press Wireless, Inc.		152
R.C.A. Communications, Inc.	Albert Frank-Guenther Law, Inc.	156
R-L Electronic Corp.	R. S. Wittenberg	148
RCA Institutes, Inc.		152
Radio Corporation of America RCA Victor Division	Kenyon & Eckhardt, Inc.	61, Back Cover
Radio Corporation of America	J. Walter Thompson Company	121
Radio Parts Company	Sidney S. Lovitt	88
Radio Supply & Engineering Co., Inc.	Karl G. Behr	84
Radio & Television Supply Co.		139
Radio Wire Television, Inc.	Diamond Seidman Co.	114
Radionic Equipment Co.	Hirshon-Garfield	154
Radolek Co.	Turner Advertising Agency	139
Raytheon Manufacturing Company	Burton Browne Advertising	91
Rider, John F. Publisher, Inc.	Lansford F. King	148
Rowe Industries		134
Runzel Cord & Wire Co.	Duane Wanamaker Advertising	123
Sauereisen Cements Company		152
Shure Brothers	The Phil Gordon Agency	129
Simpson Electric Company	Kreicker & Meloan, Inc.	96
Snyder Manufacturing Company	Phillip Klein Adv. Agency	72
Solar Manufacturing Corporation	O. S. Tyson & Company, Inc.	13
Sound Equipment Corp.	Beaumont & Hohman, Inc.	86
Sperry Gyroscope Company, Inc.	Equity Advertising Agency	146
Sperry Gyroscope Company, Inc.	Young & Rubicam, Inc.	119
Sprague Products Co.	Harry P. Bridge Company	71
Sprayberry Academy of Radio	Harry P. Bridge Company	19
Standard Transformer Corporation	Burnet-Kuhn Adv. Company	153
Stark's	C. Wendel Muench	128
Stevens Walden, Inc.	Howard-Wesson Co.	14
Stromberg-Carlson	McCann-Erickson, Inc.	108
Sun Radio & Electronics Co.	Mitchell Advertising Agency	156
Supreme Publications	Henry H. Teplitz	143
Superior Instruments Co.	Loewy Advertising Agency	107, 152
Supreme Instruments Corp.	O'Callaghan Advertising Agency	16
Sylvania Electric Products, Inc.	Newell-Emmett Company	131
Talk-A-Phone Mfg. Company	Dwight M. Blish	138
Technical Division, Murray Hill Books, Inc.	Harry P. Bridge Company	100, 101
Tech Laboratories		157
Teleplex Co.	Terrill Belknap Marsch Asso.	150
Templetone Radio Mfg. Corp.	Peck Advertising Agency, Inc.	96
Terminal Radio Corporation	Charles Brunelle	90
Triplett Electrical Instrument Co.	Western Advertising Agency	83
The Turner Company	The W. D. Lyon Co.	82
United Electronics Company	A. W. Lewin Co.	141
United Transformer Co.	Shappe-Wilkes, Inc.	79
Universal Microphone Company	Ralph L. Power, Ph. D.	22
Utah Radio Products Company	Abbott Kimball Co., Inc.	75
Wm. T. Wallace Mfg. Co.	Michael F. Mayger, Advertising	110
Ward Leonard Electric Co.	E. M. Freystadt Associates, Inc.	23
Ward Products Corporation, The	Burton Browne Advertising	65
Warner Electric Co.	Mason Warner Co.	152
Western Electric Co.	Deutsch & Shea	157
Westinghouse Electric & Mfg. Co.	Fuller & Smith & Ross, Inc.	3rd Cover, 69
Wholesale Radio Laboratories	Allen & Reynolds	104

For the widest range of transmitting and severe-service electronic assemblies . . .

AEROVOX RATING-PLUS CAPACITORS

• Critical equipment designers, builders and users are insuring their assemblies with Aerovox *rating-plus* capacitors. That Aerovox extra safety factor is widely recognized today. Service records speak for themselves.

All Aerovox paper-capacitor voltage ratings are for standard temperature, pressure and humidity conditions, namely, 20° C., 30 inches of mercury (760 millimeters), and 50% relative humidity.

Where Aerovox capacitors are in hermetically-sealed cases, the only effect caused by changes in standard conditions will be in the external flash-over voltage occurring at lower voltages for conditions involving reduced pressure and increased humidity. The capacitor proper remains unaffected.

The maximum operating temperature for continuous operation at rated voltage is 65° C. ambient. If temperature is greater, operating voltage must be reduced. Derating data will be supplied on request.

Yes indeed, it will pay you to look into this matter of Aerovox *rating-plus* insurance. Remember, it costs no more but it can save you much expense and trouble.

• ***Submit your capacitance problems. Literature on request.***

AEROVOX *Capacitors*

INDIVIDUALLY TESTED

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. · SALES OFFICES IN ALL PRINCIPAL CITIES

Export: 13 E. 40 St., New York 16, N. Y. · Cable: 'ARLAB' · In Canada: AEROVOX CANADA LTD., HAMILTON, ONT

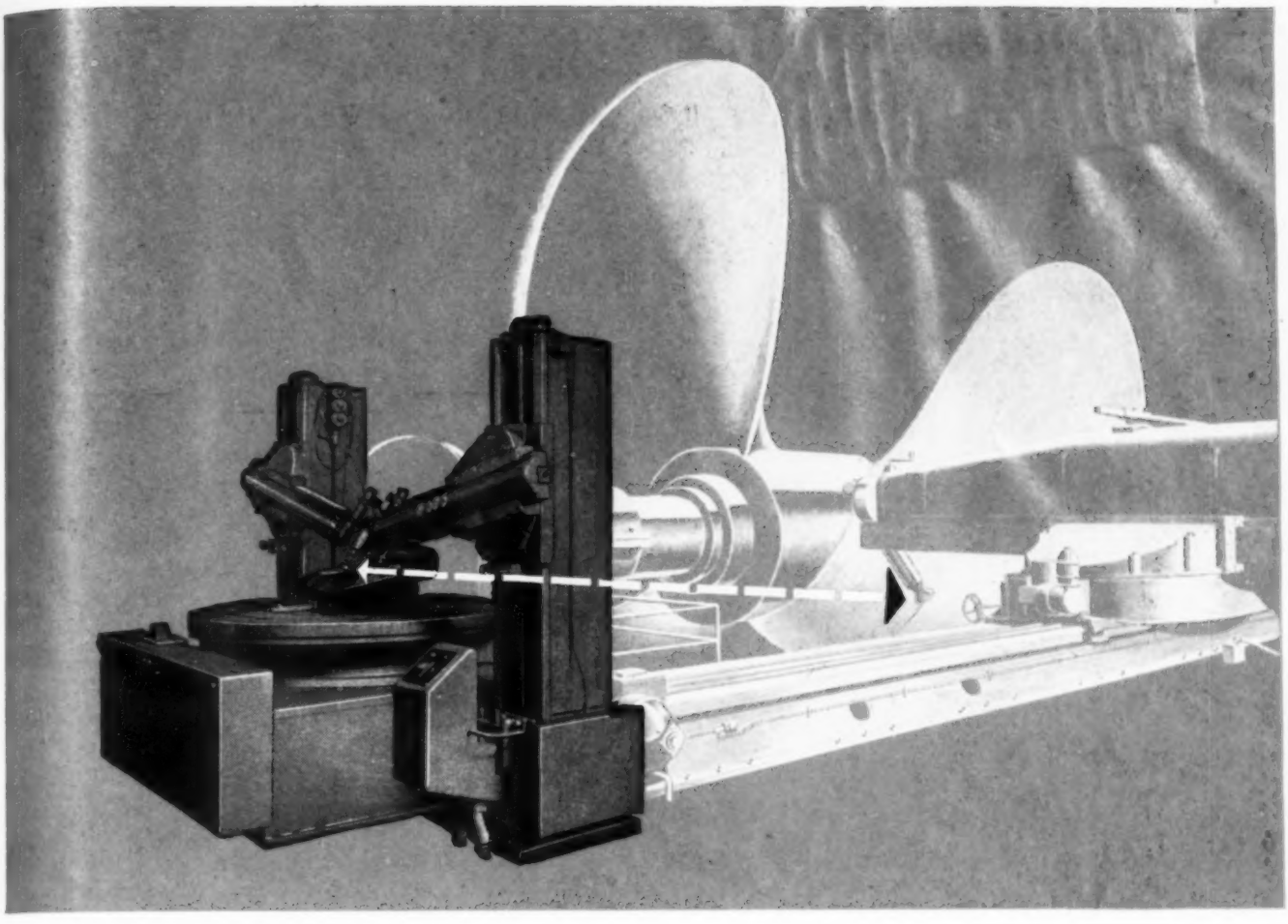
"CONTROL OF THE AIR" has a new meaning today

Yes, we're talking about a different kind of air control than that established by Allied fighters and bombers. For the air today is full of high-frequency impulses, launched by varied types of radio and electronic equipment and performing varied functions of communication, detection, ranging and safeguarding. From compact mobile radio sets to highly intricate radar equipment, Delco Radio products are helping to bring new "air supremacy" to America's armed forces. Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

KEEP BUYING WAR BONDS

Delco Radio
DIVISION OF
GENERAL MOTORS

PRINTED IN U. S. A.



tracing perfect profiles...in steel

"BRAINS" OF THE ELECTRONIC CONTROL

Shown above is the Tracer Mechanism which translates the shape of the model into a signal pattern. This pattern, through the use of electronic tubes, controls the position of the cutters as they move over the full-size casting—reproducing exactly the shape of the scale model.

TUNE IN **JOHN CHARLES THOMAS**
SUNDAY, 2:30 EWT, NBC

Finishing large nonsymmetrical surfaces—such as ship propellers—has long been an expensive and time-consuming job. Many days of skilled hand labor were required in chipping, grinding and polishing the rough casting.

But a war-born electronic development now permits the entire operation to be done by machine—with far greater accuracy than ever before possible with the most highly skilled hand labor.

An electrically controlled Tracer Mechanism follows the contour of an accurate small-scale model—made of metal, plastic or wood. The electronic position regulator (left) then guides the huge cutting machine over the full-size casting. Duplicates of the desired shape may be produced indefinitely from a single setup.

Now applied almost exclusively in production of ship propellers, this machine tool tracer control holds broad possibilities for speeding peacetime production, cutting costs, conserving skilled man power. It's another example of the new developments in electronics you'll want to know more about. For further information, call your nearest Westinghouse office, or write Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pa.

J-91069

Westinghouse

Electronics at Work

HEAR **TED MALONE**
MON. TUES WED. EVENINGS, BLUE NETWORK

ELECTRONIC EQUIPMENT FOR INDUSTRY AND HOME • ELECTRONIC TUBES • RADIO AND TELEVISION

SN-14-J93160-136
GEN LIBR
UNIV OF MICHIGAN
ANN ARBOR MICH

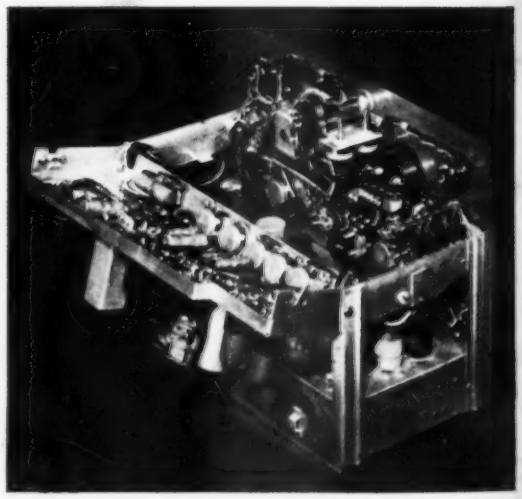
THE NEW AUDIO CHANALYST

Here is a complete test bench for sound-system servicing — a test bench which is self-contained, easily carried where needed.

Includes a calibrated high-gain amplifier for signal tracing, tube checking and gain measurement; a beat frequency oscillator with automatic sweep for testing multiple-speaker installations; a built-in Volt Ohmyst modified for linear audio measurements, an impedance tester, a high-speed Electronic Indicator, a loudspeaker, and other features.

Use this new instrument in checking microphones, amplifiers, loudspeakers, audio distribution systems, theatre sound systems, public-address systems, industrial music and announce systems.

For bulletin describing the new 170-A Audio Chanalyst write: Test Equipment Section, Dept. 255, RCA, Camden, New Jersey.



BUY MORE WAR BONDS

RCA

RADIO CORPORATION OF AMERICA

RCA VICTOR DIVISION • CAMDEN, N. J.

In Canada, RCA VICTOR COMPANY LIMITED, Montreal